CHAPTER 3
Affected Environment

INTRODUCTION

This chapter contains a description of the natural resources, economic and social conditions found in the planning area. More detailed information about the affected environment is contained in the Management Situation Analysis (USDI, BLM 1990a), a preliminary report prepared earlier in the planning process. The Management Situation Analysis is available for public review at the Big Dry Resource Area office.

AIR QUALITY

The public land in the planning area has a Class II air quality rating. The Fort Peck and Fort Belknap Indian reservations, the U L Bend Wilderness Area in Montana, and the Theodore Roosevelt National Memorial Park in North Dakota are rated as Class I. Air quality is excellent in the planning area because of the sparse population and limited industrial activity. Particulate concentrations are highest during spring and summer due to farming operations and high winds. The lowest concentration is measured during the winter, when the ground is frozen and there are no activities on the land.

A planning and management process, for prevention of significant deterioration of air quality, was introduced in the 1977 Clean Air Act amendments. This process sets limits for increases in ambient pollution levels and establishes a system for reviewing proposed pollution sources. This system has three classes: Class I is designed for areas where little deterioration to air quality would be allowed. Class II allows for moderate, well-controlled growth; and Class III allows pollutant levels to increase the most.

Potential pollution sources on or near public lands are:

- asphalt plants (particulates)
- coal mine at Savage (particulates)
- gravel crushers (particulates)
- agricultural activities (particulates)
- wind erosion (particulates)
- automobiles (carbon dioxide, nitrogen dioxide, entrained particulates)
- oil and gas operations (hydrogen sulfide gas, sulfur dioxide gas from venting and flaring activities, dust particulates from surface-disturbing activities)
- prescribed fire (particulates)

CULTURAL RESOURCES

Less than 1 percent of the entire planning area has been surveyed for cultural resources and 6.6 percent of federal surface and split estate lands have been surveyed for cultural resources. More than 975 cultural resource surveys and tests have been conducted in response to proposals in the range, lands and minerals programs. About 112,415 acres of federal surface have been surveyed at the Class III level, which resulted in the recording of 1,134 cultural resource sites. There are 650 cultural resource sites on federal surface and 484 sites are located on split estate lands.

Based on archaeological investigations and BLM's "Prehistoric Cultural Resource Overview of Southeast Montana" (Deaver and Deaver 1988), it is estimated that the average site density for the planning area is approximately 1 site per 100 acres, 6 sites per section, or 10 sites per 1,000 acres. Through consultation with the Montana State Historic Preservation Office, 38 cultural properties (26 on federal surface and 12 on split estate) have been determined eligible for the National Register of Historic Places; and 160 properties have been determined ineligible (59 federal surface and 101 split estate). The National Register of Historic Places eligibility status for the remaining 936 properties is undetermined or not available.

Cultural resources represent human occupation throughout two broad overlapping periods: prehistoric and historic. Prehistoric period cultural resource sites in the planning area are classified into four functional types: habitation or occupation, procurement, industrial and ritual.

Habitation or occupation sites contain features and materials which show everyday domestic activities (manufacture of tools, clothing and ornaments; the preparation of food and medicine; and securing shelter and warmth). These sites include lithic scatters, fire hearths, stone circles, cairns or rock piles, rock shelters, sometimes in combination. There are 842 habitation or occupation sites recorded in the planning area (535 sites on federal surface, with 24 considered eligible to the National Register of Historic Places; and 307 sites on nonfederal surface, with 12 considered eligible to the National Register of Historic Places).

TABLE 11
HABITATION OR OCCUPATION SITES
ON FEDERAL AND NONFEDERAL LANDS

	Federal Surface	Nonfederal Surface	Total
Lithic scatters	369	218	587
Lithic debris, hearths and other material	63	13	76
Stone piles	12	15	27
Stone rings	38	21	59
Stone rings, lithics and/or cairns	52	36	88
Earthen mounds	0	2	2
Rock shelters	1	2	3
Total	535	307	842

Procurement sites consist of game drive lines, animal kills and processing locations. These sites contain features representing specific subsistence activities (hunting of bison, deer or antelope and the gathering of wild plants). Buffalo jumps, traps and impoundments with associated cairn alignments and processing areas are the most common types of procurement sites. These sites are characterized by large deposits of bone at the base of bluffs, cliffs, or in steep coulees. There are 20 procurement sites known to exist in the planning area (eight kill and three alignment sites on federal surface, and nine kill sites on nonfederal surface). Of these procurement sites, the Hoe site has been determined eligible for the National Register of Historic Places. The remaining procurement sites are considered eligible.

Industrial sites are made up of lithic material quarries that consist of scatters of stone debris, hammer stones, rough or damaged tools and chunks of fine-grained stone and quartzite. Nine industrial sites have been recorded in the planning area (six federal surface and three nonfederal surface). None are considered eligible for nomination to the National Register of Historic Places.

Several sites may have ritual or ceremonial significance. These sites include rock art (petroglyphs and pictographs), burials, medicine wheels, intaglios, cairns, rock or wooden structures (used as shaman or vision quests). Rock art sites that include petroglyphs or pictographs, could be considered important for their stylistic or artistic qualities. Three sites have been identified (one rock art site and one medicine wheel site on federal surface, and one burial site on nonfederal surface). These sites have the potential to be traditional cultural properties and may be of special concern to Native American tribes.

One sensitive area was identified as a result of an American Indian Religious Freedom Act background study conducted in 1986 for BLM (Deaver 1986). This area was identified as sensitive to the Assiniboine tribe of the Fort Peck Reservation. The area is important for medicinal herbs and roots. This area does not include any federal surface but does include federal mineral estate.

The transition of the prehistoric period into the historic period was marked by the acquisition of the horse by Native Americans around 1720, and by increased contact between Native Americans and Euro-Americans (late 1700s). The historic period began with explorers and fur trade expeditions including Lewis and Clark (Moulton 1991). Late in the historic period, homesteading brought settlers into the area by the thousands. By the end of World War I, severe drought began and agricultural prices fell drastically. By 1925, one out of every two homesteader had lost or abandoned a farm. Many of these homesteads reverted to the federal government through provisions of the Bankhead-Jones Farm Tenant Act and other acts that authorized the government to buy and rehabilitate homestead lands for grazing use. These lands are now public lands.

Historic cultural resource properties are those considered at least 50 years old. There have been 225 historic period sites recorded in the planning area (74 federal surface and 151 split estate). Of these, the Powder River Depot and the Buffalo Rapids Irrigation project have been determined eligible for the National Register of Historic Places.

The predominate type of historic site is from the homestead era. The distribution of most historic sites on federal land in the planning area, coincides primarily with the Bankhead-Jones lands. Homestead sites consist mainly of foundations, depressions, artifact scatters, farmsteads, townsites, railroad sidings, rural schools, and churches from 1910 to 1925.

TABLE 12
HISTORIC SITES ON FEDERAL AND NONFEDERAL LANDS

	Federal Surface	Nonfederal Surface
Homestead remains	42	104
Stage trails	0	2
Ferry landings	1	0
Supply depots and military	2	1
Coal mines	4	3
Oil and gas	0	1
Towns	2	0
Buildings	0	1
Schools	0	2
Railroads	0	1
Graffiti	5	6
Rock piles	2	8
Graves and cemeteries	1	4
Bridges	0	2
Hearths	0	1
Irrigation projects	2	0
Civilian Conservation Corps Camps	1	0
Trash scatters	12	15
Total	74	151

In addition to the above site types, 35 historic and 35 prehistoric sites have been recorded (22 federal surface and 13 nonfederal surface). These sites consist of prehistoric lithic scatter and occupation sites mixed with historic homestead remains, graffiti and trash scatters. None have been determined eligible for the National Register of Historic Places. The following five prehistoric and historic sites warrant special protection and recognition.

Big Sheep Mountain Site

This site (360 public surface and public mineral acres) is located near Big Sheep Mountain. This property is considered significant for its range of cultural periods dating back to some 10,000 years. This site was used repeatedly, and the buried material would provide important information about time sequences and changes in use. The site contains projectile points, fire hearths, bone and tooth fragments, and stone tools and rock chips. This site is considered eligible for the National Register of Historic Places.

Hoe Site

The projectile points and pottery fragments found on the Hoe site (144 public surface and public mineral acres) show the area was used by Native Americans during the late prehistoric period. The outstanding feature of this site is three bison scapulas (shoulder blades) used as gardening hoes. Several fragments of pottery, a bone awl, stone tools and flakes, and fire-cracked rock show a farming and non-nomadic lifestyle. This is typical of the tribes in the middle Missouri River region in North and South Dakota. They lived in permanent villages and tended gardens. Sites of this type are usually not found in Montana because of the short growing season. This site represents the most western findings of possible agriculture practices of the middle Missouri tradition. This site has been determined eligible for the National Register of Historic Places.

Jordan Bison Kill Site

This site (160 public surface acres and 120 public mineral acres) is a significant Late Prehistoric bison jump. Bison jump kill sites are rare within the planning area. A sandstone cliff forms the main part of the kill site, and a nearby campsite is associated with the jump. The campsite was used at least twice, based on carbon-dating results. This site is considered eligible to the National Register of Historic Places.

Seline Site

The Seline site (80 public surface and public mineral acres) represents the trap method of bison kill sites. This site is significant because of the middle prehistoric period remains. The trap method is more common than the jump method of bison procurement. Bison were herded up a draw to the point where the draw narrowed or came to a steep end, and the bison were killed using spears or arrows. The trap method served to slow and concentrate the bison, making them easier prey for the Native Americans. This site yields two preserved bone beds with projectile points and butchering tools. This site is considered eligible for nomination to the National Register of Historic Places.

Powder River Depot Site

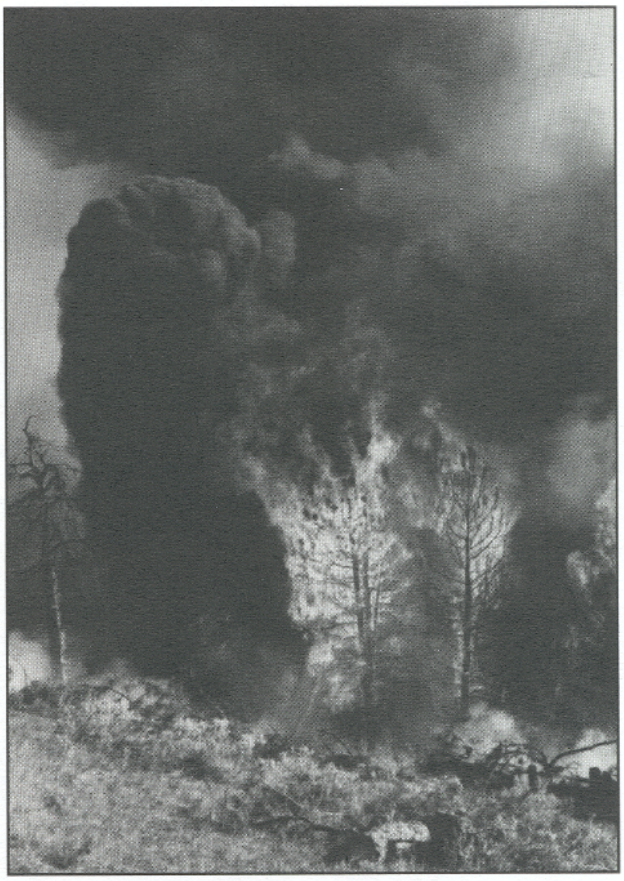
The Powder River Depot (1,386 public surface acres and 1,098 public mineral acres) reflects the military campaigns in 1876. As General Alfred Terry's column moved westward from Fort Abraham Lincoln (now central North Dakota), supply depots were established along the Missouri and Yellowstone rivers. One of these is the Powder River Depot. Most of Terry's command, including George A. Custer, rested and then proceeded west to the Little Bighorn. Left behind at the depot were three infantry companies, the 7th Cavalry band, personnel lacking proper equipment or suitable mounts, some civilian personnel, and the wagons used in the march from Fort Lincoln. As many as

3,000 soldiers camped at the depot during the peak of the occupation.

This property is considered significant for its association with the Indian War period of 1876. Following its use as a supply depot for General Terry's and Custer's commands, before heading to the Battle of Little Big Horn, this site remained as the main supply depot for the armies that pursued the Sioux and Cheyenne tribes throughout the remainder of the summer of 1876. The site contains a wealth of archeological information on the camp and the everyday life of the soldiers. The Powder River Depot site has been determined eligible for the National Register of Historic Places.

Nearby is Sheridan Butte that was used for sending messages with special mirrors, called heliographs. Etched in sandstone on this butte are the names of two soldiers who spent some time at the Powder River Depot.

Public lands in this area also contain a Lewis and Clark campsite. The location is on the north side of the Yellowstone River near the confluence with the Powder River. This is a site where Clark camped and he referred to the Powder River as the "red stone river" (Moulton 1991).



FIRE MANAGEMENT

Climate and vegetative conditions are the primary factors contributing to wildfires. Timbered breaks and shrub-grass prairie produce ample amounts of fuels. Most of the large fires caused by lightning storms occur in the Missouri River and Musselshell Breaks areas. Large fires usually are associated with years of drought conditions that consist of below-normal precipitation and above-normal temperatures. In addition, moderate to strong winds provide ideal conditions for wildfires.

In the planning area about 26 wildfires occur per year, burning 9,058 acres. Less than seven percent of the wildfires are man-caused and the remainder are caused by lightning. From mid-June through August, wildfires spread faster, burn hotter, and are more difficult to control. Aggressive initial attack by fire suppression forces, combined with lack of fuel, has restricted most fires to fewer than 40 acres. Less than 10 percent of wildfires exceed 240 acres. Fire suppression efforts the past 20 years have reduced burned acreage, but have created a fuel buildup in some areas. Examination of fire-scarred ponderosa pine shows that large intense fires historically occur every 50 to 100 years. It also is believed that less intense fires occur as often as every 10 to 15 years, with an average complete burned-over cycle of 25 years (USDI, BLM n.d.).

FORESTRY

The planning area has about 185,553 acres of forestland, with none classified as commercial (see maps 4A,B). The BLM manages forestlands in the planning area for the enhancement of other resources such as wildlife, recreation, and watershed. Public demand for wood products has been about 25 permits for 125 cords of firewood per year, 100 permits for 100 Christmas trees, and 1 permit for 100 posts and poles per year. Wildings are vegetative products sold as live plants.

The most common species of trees are ponderosa pine, juniper, and cottonwood. These species have little commercial value but are important when other resource values such as wildlife habitat and recreation are considered. There are about 3,000 acres of limber pine (see map 4B) in the Terry Badlands. Various ecological factors, particularly climate and soils, determine where these different species of trees occur.

TABLE 13
MAJOR TREE SPECIES
IN THE PLANNING AREA

Common Name	Scientific Name
Great plains cottonwood	*Populus denttoides*
Green ash	*Fraxinus pennsylvanica*
Limber pine	*Pinus flexillis*
Ponderosa pine	*Pinus ponderosa*
Rocky Mountain juniper	*Juniperus scopulorum*

HAZARDOUS MATERIALS AND WASTE MANAGEMENT

Hazardous materials are used with a variety of authorized activities. Mining, oil and gas activity, military facilities, power line and pipeline rights-of-way, weed and insect control, and prairie dog control are a few examples.

Transporting hazardous materials into or through the planning area occurs by truck and rail traffic. Major routes used by trucks are Interstate 94, U.S. Highway 2, and Montana State Highways 12, 22 and 200.

There is one site on public land suspected to be contaminated with hazardous materials. This site is the abandoned Mosby refinery in the northwestern portion of the planning area. A Class III landfill is authorized by a highway right-of-way east of Jordan, Montana, at Flowing Wells. This was authorized prior to BLM's policy of not allowing landfills on public land.

LANDS

Public landownership pattern in the planning area is highly fragmented. Access to the majority of the 1.7 million acres of BLM-administered lands is difficult limiting their public use. Access is often controlled by landowners whose private land surround the public land. Approximately 120 miles of road including two-track roads are under the BLM's jurisdiction (USDI, BLM 1987e). Approximately 10 miles of road are maintained annually. This ownership pattern also affects BLM's ability to manage the public lands in accordance with the multiple-use mandate (see maps 31A,B,C,D).

Consolidated public lands lie within Garfield, McCone, Fallon, and Prairie counties. The majority of public lands within Prairie and Fallon counties are lands reacquired from private ownership under the Bankhead-Jones Farm Tenant Act of 1937.

Land Use

Rights-of-way are used for various utility and transportation purposes, communication sites, oil and gas pipelines, and water related facilities such as ditches, canals, dikes, wells, and water pipelines.

A right-of-way for the Garfield TV Club exists within the Smoky Butte area (T. 18 N., R. 36 E., sec. 12, NW1/4 SW1/4). This right-of-way was issued in 1983 and will expire in 2008. Any land use restrictions in the Smoky Butte area will be subject to valid existing rights.

Twelve rights-of way exist on public lands along the Missouri and Yellowstone rivers. Rights-of-way include highways, railroads, power lines, pipelines and irrigation ditches.

Several unauthorized land uses have been identified. Most of these unauthorized use cases are small, agricultural trespasses that are fewer than 10 acres in size. Three occupancy trespass cases exist and are in the process of being resolved. One case involves a mobile home whose owner is unknown; one case involves an abandoned oil refinery on public land; and one case involves a barn used in an active ranch operation.

A recreation and public purposes lease was issued to Prairie County in 1976 for the Terry Badlands Scenic Overlook. An easement has been issued to Montana Department of Fish, Wildlife and Parks for a fishing access site near the Fallon Bridge.

Twelve withdrawals exist in the planning area. These public lands were withdrawn from specific uses including locatable mineral entry. The acreage and status of these withdrawals are shown in the Lands appendix. The Bureau of Reclamation withdrawals under review are mandated by the process described in the Federal Land Policy and Management Act of 1976, Section 204(L).

Five temporary land use permits have been issued: three for agricultural purposes, one occupancy permit, and a land use permit to Prairie County for a shooting range.

LIVESTOCK GRAZING MANAGEMENT

On the basis of a 1973 court decision (*Natural Resource Defense Council et. al. versus Rogers C.B. Morton et. al.*),

BLM was ordered to prepare site-specific environmental impact statements for livestock grazing activities on BLM-administered lands. The Missouri Breaks Grazing Environmental Statement (USDI, BLM 1979a) encompasses 537,000 acres in the planning area. The Big Dry Environmental Impact Statement Vegetation Allocation (USDI, BLM 1982b) addresses grazing on the remainder of the planning area. The Prairie Potholes Environmental Impact Statement Vegetation Allocation (USDI, BLM 1981c) covers 3,700 acres in Daniels, Sheridan and Roosevelt counties. The ecological condition of each grazing allotment is shown in table 52 of the Livestock Grazing Management appendix.

Current authorized livestock use is presented in table 53 in the Livestock Grazing Management appendix. Currently, 353,160 animal unit months are available for livestock use on the public lands within this planning area. Studies (USDI, BLM 1979a, 1982b) and the Vegetation appendix discuss how approximately 86 percent of the vegetation is in good to excellent condition, and that the authorized stocking rates are consistent with the vegetation resource. Authorized livestock use has not changed significantly since the above documents were issued; however, changes in livestock grazing management have improved resource values and benefitted livestock production.

The planning area contains 977 allotments. There are 486 allotments (50 percent) with 640 or fewer acres of public land per allotment, including 340 allotments (35 percent) containing 320 or fewer acres of public land per allotment.

Twenty-nine allotments graze both sheep and cattle, 18 allotments graze only sheep, and 930 allotments graze cattle. The combination of cattle and sheep varies with market conditions. Permits and leases that allow horses have been identified in table 53 in the Livestock Grazing Management appendix. One allotment is permitted to graze bison. There are about 240 ranches within the crucial winter ranges.

Usually the ranching operations are cow and calf. The calves are sold at weaning time, with most of the yearlings on public land being replacement heifers. Approximately one-half of the ranches have cow herds ranging in size from 151 to 375; one-fourth to one-third of the ranches average 150 cows. The remaining ranches have cow herds totaling more than 376 cows (USDI, BLM 1982b).

Allotments are divided into three major categories: "M" maintain, "I" improve, and "C" custodial. (See the Livestock Grazing Management appendix for information on allotment categorization.) Allotments in this planning area are: 498 in the "M" category, 71 in the "I" category, and 408 in the "C" category as shown in table 53 of the Livestock Grazing Management appendix. Criteria for allotment categorization is taken from BLM Manual 1622.

Allotments proposed for allotment management plans and activity plans are discussed in the Livestock Grazing Management appendix.

MINERALS

Minerals in the planning area include leasable energy minerals (oil, gas, and coal), mineral materials (sand, gravel, and scoria), and locatable minerals (primarily bentonite). Nonenergy leasable minerals (potash and sodium) are also present. Industry has not shown an interest in producing potash or sodium because of insufficient quantities.

GEOLOGY

The bedrock underlying the subject lands is composed of sedimentary geologic units ranging in age from Late Cretaceous to Paleocene, which overlie older rocks ranging in age from Precambrian to Cretaceous (see table 14). During the Late Cretaceous Period, eastern Montana was flooded by a large shallow sea. The shoreline moved back and forth several times leaving alternating beds of marine and continental deposits.

Upper Cretaceous units underlying these lands include the Bearpaw Shale, the Fox Hills Sandstone, and the Hell Creek Formation. The Bearpaw Shale consists primarily of massive gray to black marine shale, and shaley claystone containing local thin beds of siltstone, silty sandstone, and bentonite. The Fox Hills Sandstone consists of lower and upper predominantly fine to medium-grained sandstone units separated by a thin shale bed. The Hell Creek Forma-

TABLE 14
GENERALIZED STRATIGRAPHIC COLUMN FOR THE PLANNING AREA

Era	Period	Epoch	Age Mya[1]	Formations: Western	Formations: Eastern	Typical Fossils
CENOZOIC	QUATERNARY	RECENT	0	ALLUVIUM	ALLUVIUM	
		PLEISTOCENE		RIVER GRAVELS	RIVER GRAVELS	MAMMOTH PETRIFIED WOOD
	TERTIARY	PLIOCENE	4		FLAXVILLE FORMATION	
			8			
CENOZOIC	TERTIARY	PALEOCENE	56	FORT UNION FM[2]: TONGUE RIVER MEMBER	FORT UNION FM[2]: TONGUE RIVER MEMBER	PETRIFIED WOOD
			60	FORT UNION FM[2]: LEBO MEMBER	FORT UNION FM[2]: LUDLOW MEMBER	SNAILS CLAMS
			64	FORT UNION FM[2]: TULLOCK MEMBER		MAMMALS
MESOZOIC	CRETACEOUS	UPPER	68	HELL CREEK FORMATION	HELL CREEK FORMATION	DINOSAURS
			72	FOX HILLS SANDSTONE	FOX HILLS SANDSTONE	
			76	BEARPAW SHALE	PIERRE SHALE	BACULITES
				JUDITH RIVER FORMATION		DINOSAURS
				CLAGGETT SHALE		CLAMS
			80	EAGLE SANDSTONE		BACULITES
			84	TELEGRAPH CREEEK FM[2]		
			88	COLORADO GROUP		CLAMS
			92			

[1]mya = million years ago

[2]FM = formation

tion is composed of sorted medium-grained sandstone in the lower part of the unit and soft claystone, shale, siltstone, fine to medium grained sandstone, and thin coal beds in the upper part. The continental deposits of the Hell Creek Formation are world-famous for fossil remains of Tyrannosaurus Rex and Triceratops (see "Paleontology" in this chapter).

The Paleocene Fort Union Formation is composed of the Tullock, Lebo Shale, and Tongue River Members in ascending order. Interbedded shale, siltstone, sandstone, and thin coal beds of the lower Tullock Member grade upward into silty or sandy shale and local sandstone. The Lebo Shale Member is mostly dark shale containing interbeds of siltstone and thin coal beds. The Tongue River Member is composed of alternating sandstone, siltstone, shale, and thick, extensive coal beds.

During the Late Cretaceous and early Tertiary periods, a great amount of volcanic activity occurred in western and central Montana. Many clouds of volcanic ash and dust settled in the planning area. As this ash weathered, it eventually became bentonite (or bentoniferous clay) which is common throughout the area. Outcrops of clinker (locally called red shale or scoria) also are common. Clinker deposits, composed of the residue from burned coal beds and baked and fused overlying layers, occur throughout the coal-bearing formations.

Alluvium of Quaternary Age and terrace deposits of Quaternary and Tertiary Age are composed of interbedded clay, silt, sand, and gravel, and make up the youngest geologic units in the area. Terraces occur mainly near valley sides and uplands along the Yellowstone River. Alluvium is thickest along the Missouri and Yellowstone rivers and their major tributaries, but is present along many smaller streams. Glacial drift of Wisconsin age, principally consisting of ground earth and stone, and outwash deposits, occurs in the northern part of the planning area. The ground moraine consists of a compact mixture of clay, silt, sand, pebbles, cobbles, and boulders. Outwash deposits resulting from receding glacial ice are present in channels that have eroded into the moraine (Slagle 1984).

Glaciers of the Wisconsin stage of the Pleistocene epoch, within the last million years of geologic time, covered the northern half of the planning area. The glaciers covered everything north of the Missouri River and extended as far south as Intake on the Yellowstone River. The major drainages south of the Missouri River flow north. These drainages were blocked or dammed by the glacier. This created three large lakes along the drainages; Lake Glendive, Lake Jordan, and Lake Musselshell. Each of these would have been several times larger than the present Fort Peck Reservoir.

COAL

Coal beds of economic interest in this area are in the Tongue River Member of the Fort Union Formation (Paleocene Age, about 60 million years old). The Fort Union Formation covers the eastern two-thirds of the planning area. The formation is alternating layers of sandstone, siltstone, claystone, and lignite coal.

The Fort Union Formation is located mainly in the Williston basin. The southern edge is bounded by the Miles City arch which separates the Williston basin from the Powder River basin farther south. The Cedar Creek anticline is a prominent structural feature as it enters the southeast corner of the planning area, passes near Baker south of Glendive, and stops 15 miles northwest of Glendive. Erosion on the Cedar Creek anticline has cut through the Tongue River Member to the formations underneath. As a result, the area of the anticline is a strip 4 to 10 miles wide and 80 miles long where the coal beds have no economic potential.

The coal beds of the Fort Union Formation range in thickness from thin films to a reported 40 feet. Generally, only beds at least 5 feet thick are considered of economic interest. Fort Union coal is ranked as lignite and has a heating value range from 5,000 to 7,500 British thermal units per pound. Eastern Montana coal typically has high moisture, and low ash and sulfur content (see table 55 in "Coal" section of the Minerals appendix).

Coal resources in the planning area total 19.276 billion tons (of which 47.5 percent or 9.164 billion tons is federal). (See table 56 in the "Coal" section of the Minerals appendix.) The method for identifying coal with development potential is discussed in the "Coal" section in the Minerals appendix. The acquisition of new data would refine or allow for additional areas identified with coal development potential.

The Knife River Coal Company holds the only federal coal lease in the planning area. The lease is for 440 acres at Savage, about 24 miles southwest of Sidney. The mine produced 283,173 tons of lignite in 1991. The coal is mined for use in the power plant at Sidney. It is the only operating coal mine in the planning area.

At present the Fort Union Coal Region is decertified. In a decertified (deactivated) federal coal region, interest in coal leasing has decreased to the point that the Regional Coal Team and the BLM Director agree that regional planning of coal leasing is no longer necessary. Coal is subject to individual tract analysis and lease-by-application rules (43 CFR 3420.1, BLM Manual H-3420-1). Any party desiring a coal lease can apply, and the application would be consid-


Knife River Coal Mine, Savage.

ered on its own merits. The coal planning process is described in the "Coal" section of the Minerals appendix.

LOCATABLE MINERALS

Locatable minerals include uranium, gold, agates and bentonite. Bentonite is exposed extensively, but there is little data that can specifically give us precise quantity and grade to accurately evaluate resource potential. Bentonite is the most likely to have development potential, but industry interest has been little to none. Locatable mineral claims and occurrences are shown on maps 9A,B,C,D.

Bentonite is the major locatable mineral in the planning area. Bentonite clay is common in the Cretaceous Hell Creek Formation and Bearpaw Shale that underlies the coal bearing Fort Union Formation. It is exposed along the Missouri River as far downstream as Brockton on the Fort Peck Indian Reservation, and along the center of the Cedar Creek anticline from Baker to Glendive. There are five mining claims for bentonite; one is near Vananda, Montana, and four are south of Mosby.

Mining claims have been staked on Smoky Butte from 1938 to the present. A shaft has been dug into a small vein, but it has not been recorded as produced. There is low potential anticipated for locatable minerals such as gold, chromium, titanium, zeolite, and associated minerals such as copper, lead, and zinc. The similarity between Smoky Butte intrusives and diamond-bearing deposits found elsewhere in the world suggests that there is a potential for diamonds.

Uranium exists in some coal beds as a combination of metal and organic compounds. In general, the coal beds of the planning area are barren of uranium. However, thin coal beds with an average grade of about 0.01 percent uranium have been found between Wibaux and Baker, Montana (Jarrard 1957). There are two uranium claims on an unnamed coal bed in the Hansen coal bed zone near Wibaux. Testing by the Atomic Energy Commission in the 1950s (Denson and Gill 1965) showed that extraction of the uranium was not possible.

Gold placer mining from the gravels of the Yellowstone River as far downstream as Miles City (Ronning 1991) occurred in the 1930s; there is no record of the quantity. Gold mining is recreational in the planning area, as is agate hunting in the gravels of the Yellowstone River.

MINERAL MATERIALS

Scoria, sand and gravel are the major mineral materials found in the planning area (see maps 10A,B,C,D). Most of the deposits are privately owned. Scoria deposits are the result of the baking of overlying rock by burning coal beds. Scoria is associated with most lignite coal occurrences. Sand and gravel are found in alluvial, terrace, and glacial deposits. Alluvium is thickest along the Missouri and Yellowstone rivers and their tributaries, but also along many smaller streams. Terraces are mainly near valley sides and uplands along the Yellowstone River. Glacial deposits cover the northern part of the planning area. Streams at the front of retreating glaciers concentrated sand and gravel in outwash channels.

OIL AND GAS

The planning area has the largest number of oil and gas fields (more than 170) in the state. These fields produced 15.1 million barrels of oil in 1989, which was 70 percent of Montana's total oil production for 1989 of 21 million barrels. Federal oil and gas lands total 2,333,489 acres in the planning area, with 531,168.364 acres leased as of April 1991. Of the producing fields reported at the end of 1988, only two were gas fields: Cedar Creek on the Cedar Creek anticline, and Charlie Creek North in the Williston basin.

Several geologic features (Cedar Creek, Cat Creek, and Redwater anticlines) dominate oil and gas production (see map 8). Structures include Ekalaka, Sheep Mountain, Opheim, and Blood Creek synclines. Three major fault zones are in the area of the Vandalia, Weldon, and Brockton-Froid faults. Major domes include the Porcupine and Poplar domes. The Miles City arch forms most of the southwest edge of the planning area. The Williston basin is the only large basin in this area. Oil and gas production is concen-

trated in the Cedar Creek anticline and the Williston basin. Gas was discovered on the Cedar Creek anticline in 1920, and oil in 1936. This anticline is in the southwestern limit of the Williston basin and trends northwest-southeast. Oil was discovered in the Williston basin in 1951. The opener for production in Montana was the Richey field about 55 miles northwest of Glendive.

Areas classified as high oil and gas development potential consist of 237,014 public mineral acres. The remainder of the planning area (2,096,475 acres) is classified as moderate development potential. The high development potential classification is based on: (1) a sedimentary package of Paleozoic and Cretaceous rocks more than 5,000 feet thick, and several formations within the package that are productive in this area or elsewhere in the state, and (2) a geologic setting with potential for structural and stratigraphic traps. The moderate occurrence classification is based on: (1) a sedimentary package believed to contain source beds of marine shales or fossiliferous carbonates, and (2) a geologic setting with potential for structural and stratigraphic traps.

TABLE 15
FEDERAL OWNERSHIP OF
HIGH AND MODERATE
DEVELOPMENT POTENTIAL OIL AND GAS

	Percent
High Areas	
Cedar Creek anticline	17
Williston basin	2
Cow Creek/Richey	8
Mosby dome	71
Sumatra	14
Moderate Areas	17
Planning Area	17

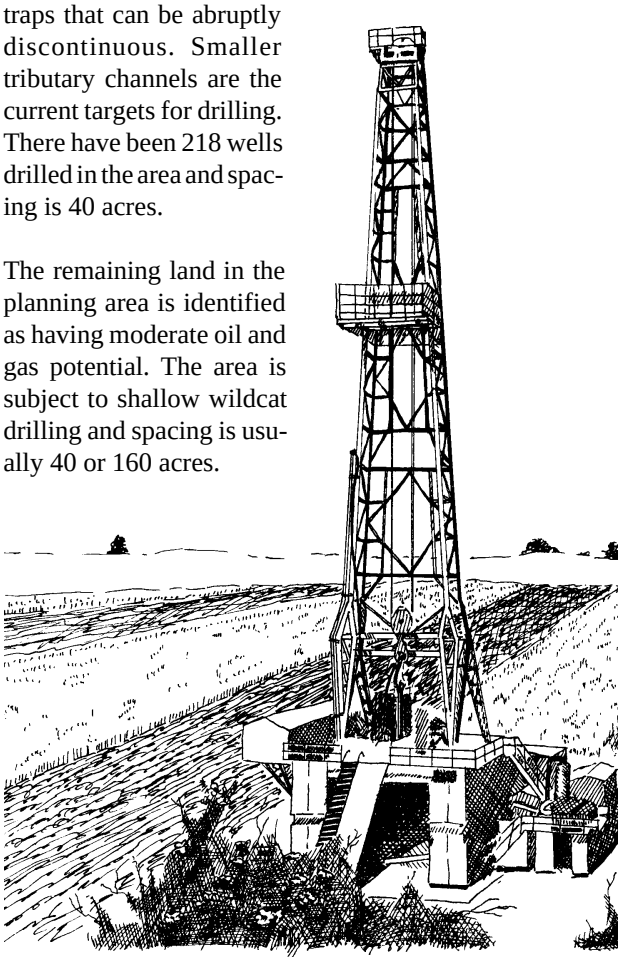
The producing townships along the trend of the Cedar Creek anticline have been identified as having high oil and gas development potential. Primary drilling targets along the anticline are the Cretaceous Eagle Gas Sands, and the Mississippian Madison, Silurian, and Ordovician Red River Formations. In this area, 29 townships were tested in the last 16 years with an average of 13 wells per township. Most wells drilled here are oil tests and development wells for established fields, with well spacing commonly 80 to 160 acres (see figures 13 and 14 in the Minerals appendix).

The largest area of high oil and gas potential is the portion of the Williston basin extending into the planning area. Oil fields in the Williston basin are predominantly in Richland, Roosevelt, and Sheridan Counties. The following Formations are productive: the Mississippian Madison, the Mississippian/Devonian Bakken, the Devonian Nisku, Duperow, and Winnipegosis, the Ordovician Gunton, and Red River Formations. These multiple zones give the Williston basin high potential despite the depth of most of these formations.

Many fields include combination traps (small structural closures with lithologic variations) that control the location of oil in the structure. During the 16 years before 1988, 90 townships with high potential in the Williston basin were tested. About 14 wells (most with spacing of 160 acres) were drilled in each township; many were wildcats. Another high potential area is the Cow Creek/Richey field in McCone County. Over the last 16 years, six townships have been tested. The drilling targets are shallower than those in the Williston basin; well spacing averages 40 acres.

The last two areas of high oil and gas potential are in Garfield and Rosebud counties. Mosby dome is on the Cat Creek anticline and is a location for development drilling. Twelve wells have been drilled in the last 16 years. The second area is the east end of the Sumatra anticline. Production is primarily from the Pennsylvanian Tyler sands. Fluvial beds that fill channels were eroded into Mississippian-age marine shales and limestones resulting in oil traps that can be abruptly discontinuous. Smaller tributary channels are the current targets for drilling. There have been 218 wells drilled in the area and spacing is 40 acres.

The remaining land in the planning area is identified as having moderate oil and gas potential. The area is subject to shallow wildcat drilling and spacing is usually 40 or 160 acres.



PALEONTOLOGY

There are three classes of fossils: vertebrate, invertebrate, and plant fossils. Significant fossils are defined as fossils from vertebrate animals and other rare or unusual fossils, or fossils from unusual situations. Vertebrate fossils discovered in formations or sediments with low discovery potential are often considered significant because of the rarity of these types of localities. Invertebrate and plant fossil localities can also be considered significant due to their rarity.

Three formations noted for their significant fossil material are the Judith River Formation, the Hell Creek Formation, and the Tullock Member and its equivalent portion of the Ludlow Member of the Fort Union Formation (see maps 12A,B,C,D). The Judith River Formation preserves the remains of ancient environments ranging from shallow ocean to deltas and rivers to freshwater swamps and lakes. In addition to plant remains, many animal species are found in this formation. Mollusks, fish, amphibians, lizards, dinosaurs, other reptiles, and small mammals are represented in the fossil record.

The Hell Creek Formation was deposited as low plains interrupted by broad swampy river bottoms and deltas. The fossils show a tropical to subtropical climate and a wide diversity of plants are evident. Mollusks, fish, amphibians, dinosaurs (*Triceratops, Anatosaurus, Tyrannosaurus*), other reptiles, birds, and small mammals are abundant in the Hell Creek fossil record.

An important event in time is represented at the contact of the Hell Creek Formation and the Tullock and Ludlow members of the Fort Union Formation. This contact represents the time of the worldwide extinction of many life forms, most notably the dinosaurs, and the beginning of rapid mammal evolution.

The Fort Union Formation has a wide variety of plant fossils that show streamside swamps, bottomlands, and riparian communities along well-established river courses. Channel fillings in the formation contain an abundance of freshwater clams and snails. Most of the significant fossils (turtles, fish, reptiles, and mammals) are found in the Tullock Member, and the equivalent beds in the lower part of the Ludlow Member.

There are 2,653,303 acres of geologic formations that may contain significant paleontological resources in the planning area; 560,243 acres (21 percent) are located on public lands.

TABLE 16
GEOLOGIC FORMATIONS
CONTAINING SIGNIFICANT
PALEONTOLOGICAL RESOURCES

Geologic Formation	Total Acres	Public Acres
Judith River Formation	220,453	8,609
Hell Creek Formation	1,463,193	350,068
Tullock Member and its equivalent in the Ludlow Member of the Fort Union Formation	969,657	201,566

The Hell Creek Formation contains the best example of the last period of the Age of Dinosaurs in the United States. The Hell Creek Formation and the Tullock Member exhibit an uninterrupted sequence of the last of the dinosaurs, their extinction, and the beginning of the Age of Mammals.

Four specific areas with high concentrations of significant paleontological resources are within the planning area. They are the Hell Creek (19,169 acres), Bug Creek (3,840 acres), Sand Arroyo (9,056 acres), and Ash Creek Divide (7,931 acres) areas. The Hell Creek area includes a portion of the Hell Creek National Natural Landmark (see map 12A).

Since collecting began in 1903, the planning area has been important for paleontological research. Rock exposures that produce significant fossils, particularly vertebrate fossils, are of considerable scientific value and interest. Several localities have yielded the only known fossil record for various extinct animals. A total of 940 recorded localities lie within the boundary of the planning area. The Garbani, the Harbicht Hill, and Flat Creek localities are considered significant, which means they have produced important paleontological data and have the potential to produce more.

RECREATION

Traversing the planning area are U.S. Highway 2 and Interstate 94. The residents and tourists can experience a variety of recreational opportunities: fishing, hunting, sightseeing, boating, camping, hiking, picnicking, agate hunting, off-road vehicle use, bird watching, and winter activities such as snowmobiles and cross-country skiing. Other than picnic tables at some of the more popular fishing areas, there are no developed recreation sites on BLM-administered lands. The Montana Statewide Comprehensive Outdoor Recreation Plan shows a high participation of recreational activities and cites fishing as the one most in

need of additional facilities (State of Montana, MDFW&P 1988).

Off-road vehicle use on public lands is any motorized vehicle traveling off the existing roads and trails. This travel is usually associated with hunting and fishing as well as mere pleasure driving. The two areas where off-road vehicle use is popular are south of Makoshika State Park, and next to the Terry Badlands and the Yellowstone River.

Many fishery reservoirs offer trout and bass; some reservoirs have northern pike. Winter months provide opportunities for ice fishing. To a limited extent, the public lands have access to the Yellowstone and Missouri rivers where fishermen can catch catfish, walleye, sauger, sturgeon, paddlefish, pike and bass. Deer, elk, antelope, waterfowl, and upland game birds provide hunting opportunities. Most of the Yellowstone River's shoreline is privately-owned, access is limited, especially for hunting. Legal access is available by the river (streamside access). The Montana Department of Fish, Wildlife and Parks provides some marked fishing access sites. Calypso and the Powder River Depot areas also provide access.

The Calypso area (69 acres) is next to the Terry Badlands Wilderness Study Area, along the Yellowstone River, west of Terry, Montana. The area is undeveloped, but has potential for a developed recreation area and could provide the local region additional recreational opportunities for developed camping and picnicking, especially for visitors using the Terry Badlands area.

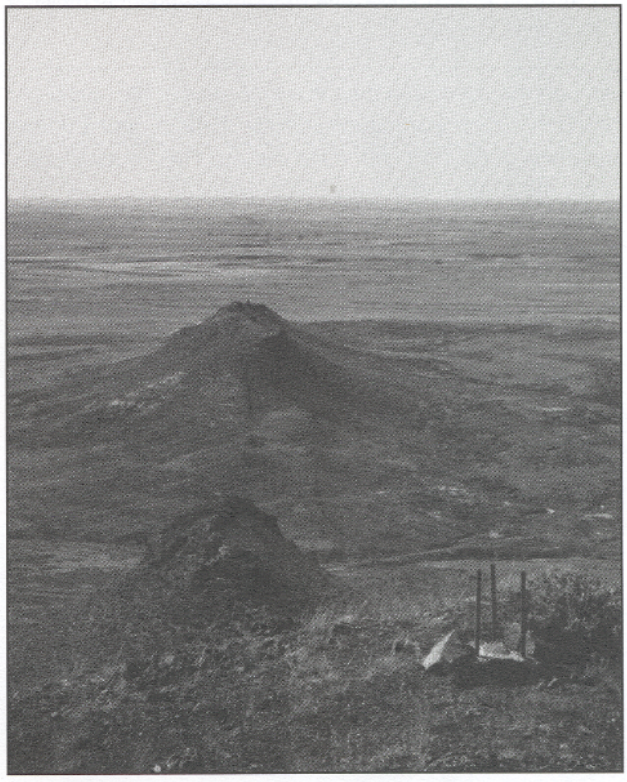
Calypso area.

The Cherry Creek area (2,858 acres) is located north of Terry, Montana. The area is undeveloped, but has potential for a developed recreation area if a dam is constructed. The area could provide a fishing reservoir with an overnight campground and day-use facilities.

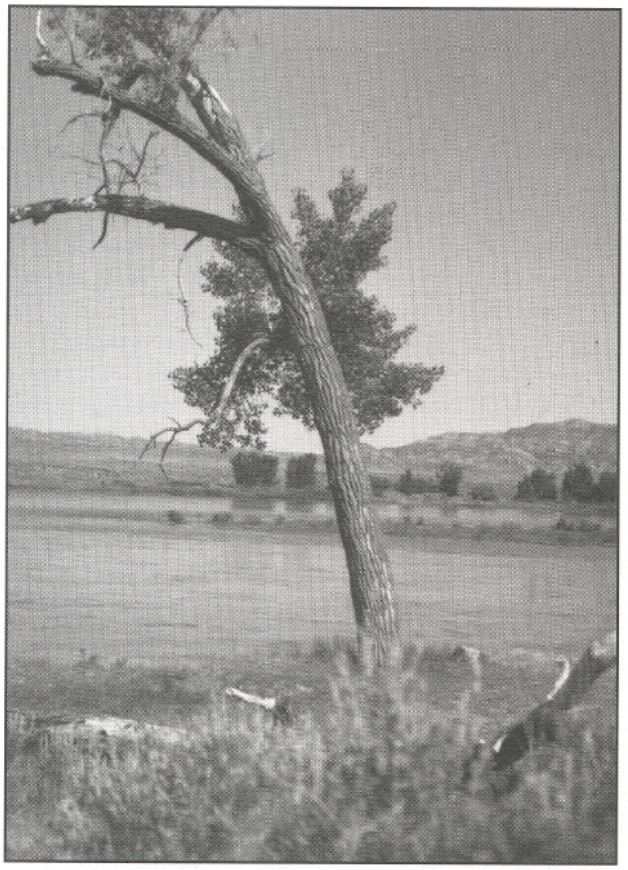
The Lewis and Clark National Historic Trail traverses the planning area along the Missouri and Yellowstone rivers (see pocket maps 31A,B,C,D). There are approximately 14,000 acres of public lands along these rivers with potential for recreation development including fishing access, camping and picnicking. Public land parcels are scattered along the trail. The Missouri River has no public land parcels close enough to the Lewis and Clark campsites to warrant on-site interpretation. The only known place where Clark camped (on what is now public land in this planning area) is a site on the north side of the Yellowstone River near the confluence with the Powder River.

The Calypso Trail is the only other established trail in the planning area. It is a motorized trail bordered on both sides by the Terry Badlands Wilderness Study Area. The original trail was located mainly to the east and was used as a freight hauling route during construction of the Milwaukee Railroad. The Calypso Trail is used primarily by hunters in the fall and livestock grazing permittees to access rangeland improvements. Other recreation opportunities on the trail include pleasure driving, sightseeing, hiking, and mountain biking.

Smoky Butte (80 acres) is located near Jordan, Montana. It is a landmark feature that guided early day travelers through the area. The rocks present at Smoky Butte consist of rare minerals, including Armalcolite, a mineral found in samples of rock from the moon (see "Smoky Butte" in the Areas of



Smoky Butte.



Powder River Depot.

Critical Environmental Concern appendix). Smoky Butte has been reported in scientific trade journals and other publications. It is not legally accessible. Mining claims have been staked, but no mining has taken place. (See the "Locatable Minerals" section of the Minerals appendix for a description of the mining process).

Makoshika State Park (8,123 acres) near Glendive, Montana, is managed by the Montana Department of Fish, Wildlife and Parks (see map 17). This park contains 3,924 acres of public lands next to its boundaries. Makoshika State Park is characterized by rough breaks and badlands.

In 1976, Prairie County was issued a 42-acre lease under the Recreation and Public Purposes Act for the Terry Badlands Scenic Overlook. This area offers an excellent view of the Terry Badlands area and is also identified as a wildlife viewing area. Existing facilities include a outdoor toilet facilities and directional signs.

The Powder River Depot (171 acres) is next to the Powder and Yellowstone rivers. This area is popular for fishing access, camping, casual day use such as walking, photography, and wildlife observation. The area supports cottonwoods and willows on the bottomlands with sagebrush and grasses on the uplands. The history of the Powder River Depot is discussed in the "Cultural Resources" section of this chapter.

Some public lands are physically inaccessible due to the lack of roads or trails, others do not have legal access across private lands. Due to the scattered land pattern, access to many small parcels of public land frequently is blocked by private land (see pocket maps 31A,B,C,D). Acquiring legal access is an active BLM program and is accomplished by land exchanges and purchasing easements.

Visual Resources

Visual resources are the visible features in a landscape. The physical features are the landform, water, vegetation, animals, structures, and other man-made or natural features. Visual resource management is the art of managing change in a landscape so the change is in harmony with the physical features of the landscape. Because it is neither desirable nor practical to provide the same level of visual management on public lands across the planning area, an evaluation process is used. The evaluation considers three factors: scenic quality (visual appeal), sensitivity (public concern for scenic quality) and the distance that the landscape is from the observer. Based on these three factors, the public lands are placed into one of four visual resource inventory classes. Classes I and II are the most valued, class III is moderate, and class IV is the least valued.

The visual resources in the planning area were inventoried from 1977 to 1982. The 13 counties portray a variety of landscape habitats, with most of the land being prairie. There also are woody draws, riparian/wetlands, cottonwood river bottoms, badlands and river breaks, all having different visual qualities, character, and natural beauty. These landscapes vary in the ability to absorb change without significant project design.

SOCIOECONOMICS

SOCIOLOGY

The planning area encompasses all, or portions of, 13 counties in eastern Montana. The counties analyzed were Daniels, Dawson, Fallon, McCone, Prairie, Richland, Roosevelt, Sheridan, Wibaux and part of Garfield. Parts of Custer, Rosebud, and Carter counties also lie within the planning area, but are not discussed in this analysis because the amount of public land in the planning area in these counties is minimal. Counties with the most BLM-administered surface land are Garfield (493,552 acres), Prairie

(447,427 acres), McCone (200,622 acres), and Fallon (120,009 acres). The community of Miles City, located in Custer County south of the planning area, is included in this discussion because it is a major trade and service center for the planning area.

Demographics

In 1990, 47,760 people lived in the planning area, a decline of 12 percent from 1980. In Fallon, Garfield, McCone, and Prairie counties, the population declined 16 percent to 8,351 between 1980 and 1990. Miles City had a 1990 population of 8,461, which was 12 percent lower than the 1980 population (see table 59 in the Socioeconomics appendix). The planning area population is expected to continue to decline through the year 2005 due to young people leaving for advanced education, military service, and employment. Other population trends include migration from farm and ranch to town due to retirement, farm or ranch consolidation, and population aging.

Social Well-Being

Social well-being indicators present the mix of positive and negative factors associated with rural areas. Positive factors include the area's remoteness and sparse population that result in freedom from urban problems such as high crime rates and overcrowding. Divorce rates are low compared to state statistics, outdoor recreational opportunities are plentiful, and family ranching operations remain predominant (see Socioeconomics appendix).

Negative factors include the lack of some services. The number of physicians per 100,000 population is lower than the ratio for the nation and the state. Education levels are lower than the state level. The proportion of housing lacking some or all plumbing (a housing quality indicator) is higher in several of the counties than for the state. In some counties, average family incomes are much lower than statewide. The percent of families below the poverty level is higher in all counties (except Richland and Dawson) than statewide. Unemployment has been a chronic problem, resulting in a loss of people in the working age group (18 to 64 years). They move out of the area to attend school or find employment (see table 60 in the Socioeconomics appendix).

Many qualities of life are called intangibles, because they are difficult to quantify. At a personal level, these qualities are a real part of what makes life pleasurable and worth living. They include a sense of belonging in one's community; having control over the decisions that affect the future; knowing that one's government strives to benefit everyone equally; living without fear of crime or personal attack; and feeling confident that children get a fair start in life (USDI, BLM 1982d).

Information on local social conditions (based on discussions with 100 residents in the planning area [Trent 1991]) showed that most residents felt their lifestyle needs were being met. Those who say their needs are not being met said that lack of cultural activities and tough economic times are the reasons. The most important aspects of their area and community are the outdoors and wide open spaces, good people, small town atmosphere, keeping the community alive, the ability to earn a living, enjoying outdoor recreation, and that the area is a good place to raise children (see Socioeconomics appendix).

Social Trends

The anticipated trends related to recreation are: changes in types of recreation due to the aging population; increasing leisure time; and growth in tourism, vacation and travel. These latter two trends will occur at the state and national level. Trends related to services are: changes in the types of service due to aging populations, and a decreasing tax base to provide these services. In addition, increased concern about environmental effects on the earth will become clearer among the general public, the media, and politicians.

Attitudes About Land Management

This information reflects discussions with about 100 area residents and interested individuals who represented a variety of viewpoints (Trent 1991). Discussions in March and April of 1991 revealed the respondents' ideas about land use and preferences for land management by the BLM. Respondents were likely to have multiple interests in public lands including ranching, hunting, concern for community development, and concern for protection of soils and vegetation. These multiple interests gave them a broad perspective on BLM management. Many respondents stated the importance of multiple uses and support for resource protection (see figure 4) while allowing a variety of activities on public lands (see figure 5). Vegetation and soils were identified as the resources most important to protect, with livestock grazing and hunting the most favored activities. Many respondents said that BLM is managing the public lands well. One-half said they saw no problems, and about one-third said they did not think there was a threat to the resources or use of the public lands.

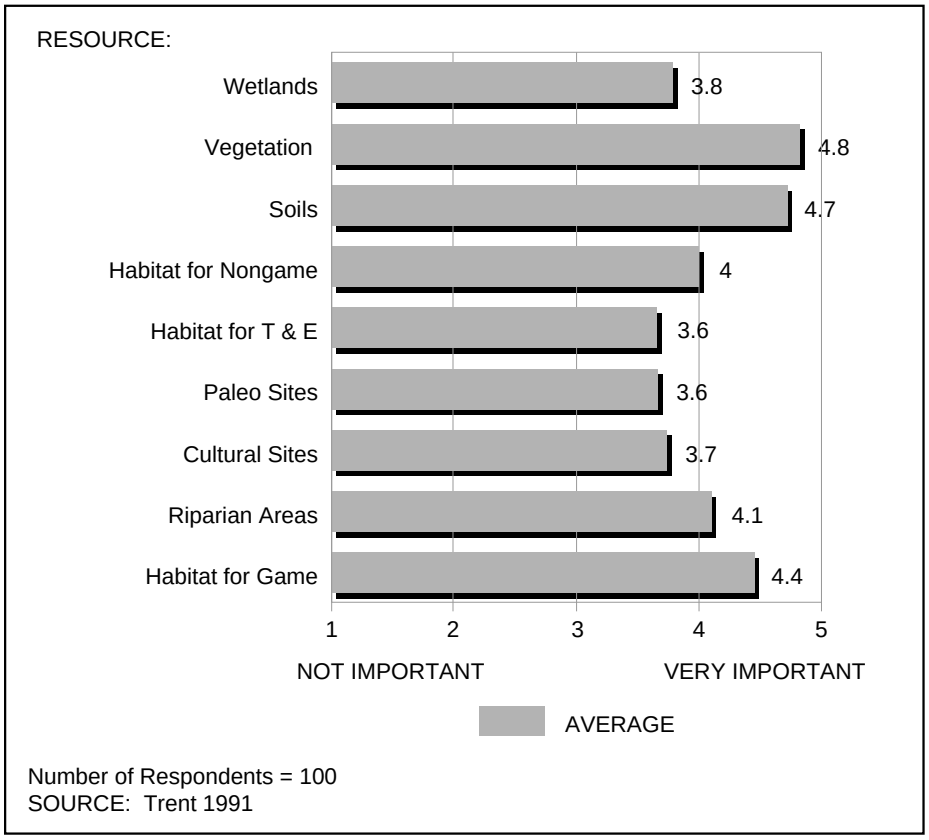
Concern about local economic conditions was predominant among the respondents. They were concerned about young people and families leaving the area to seek employment

elsewhere, declining farm populations, local businesses closing, and lack of funds for public services because of the declining tax base. Most respondents said that BLM does affect their community and economy. In addition, respondents felt BLM should consider economic impacts to local communities when making land use decisions, and should manage lands with high recreational potential more aggressively because communities could benefit economically.

Respondents were concerned about the livestock industry. They said livestock grazing was their main interest, as well as the most threatened use on public lands, and they perceive a push from the outside to deemphasize grazing. The importance of livestock grazing is recognized by most area residents, not just those directly associated with ranching.

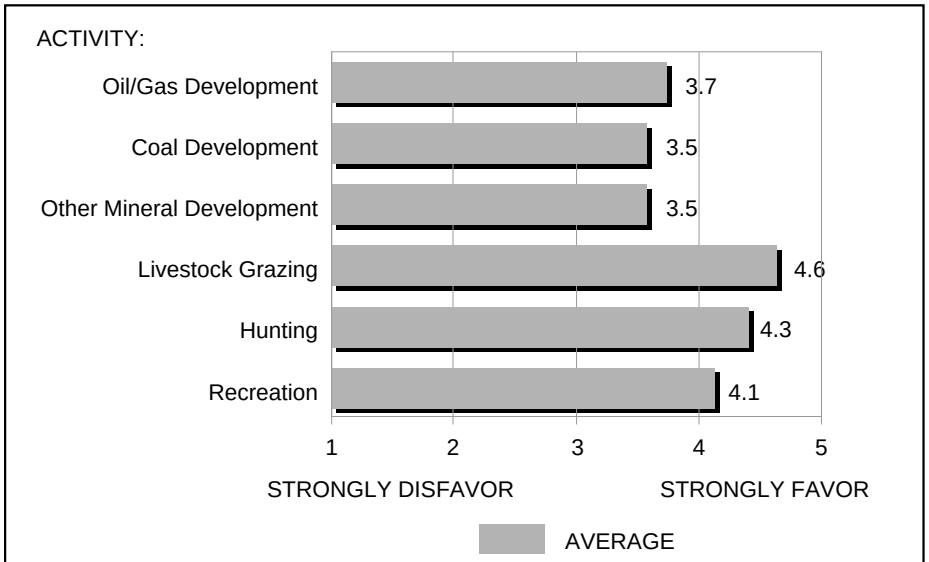
An interest in resource protection was evident during many of the discussions. Respondents said that land use was the second most threatened resource on the public lands. In addition, disturbance to lands from overgrazing and off-road vehicle use was a concern. These respondents, as well as other local and regional individuals and groups, are concerned with resource protection and preserving special resource values such as wildlife habitat and riparian/wetlands.

FIGURE 4
IMPORTANCE OF RESOURCE PROTECTION ON BLM LANDS



Number of Respondents = 100
SOURCE: Trent 1991

FIGURE 5
FAVOR/DISFAVOR ACTIVITIES ON BLM LANDS



SOURCE: Trent 1991

Respondents indicated that outdoor recreation was important. Land use changes observed in the past 10 years include loss of access. Many said that demand for recreation would increase in the future, with at least some of that demand coming from outside the area. Most of the respondents engage in outdoor recreation with the average person participating in 2 to 3 activities with hunting, fishing, hiking, and camping being the most popular. Nearly half the respondents said they have difficulty identifying public lands; ten percent indicated they can sometimes identify public lands.

Respondents were given a list of resources and asked to choose items they wished to discuss. Topics that generated the most interest were off-road vehicle use, recreational area management, crucial winter range management, development in high potential oil and gas areas, and black-footed ferret reintroduction. At least 58 percent discussed each of these resources or uses and the responses varied. In some cases, such as big game crucial winter range, respondents felt current management practices were acceptable. In other cases, such as off-road vehicle use and recreation area management, changes in current management practices were suggested. The responses were fairly uniform about off-road vehicle use and recreation, but divided about the black-footed ferret reintroduction and land transfers.

Off-road vehicle use was the most popular topic, with substantial agreement on its management (see figure 6). Sixty-five percent said off-road vehicle use should be limited. Fewer than 20 percent said off-road use should be open. Respondents were asked whether off-road vehicle use should be limited in areas such as paleontological and cultural sites, crucial winter habitat for wildlife, special management recreation areas and the black-footed ferret reintroduction area. In all cases, respondents indicated use should be limited.

Strong support was given for recreational development, particularly the Cherry Creek and the Powder River Depot sites (see figure 7). Support for Cherry Creek is due to increased recreational and economic opportunities that could occur if the area were developed. Respondents were divided on whether use of the special management recreational areas should be limited to recreation or whether grazing and other activities should be allowed.

Respondents who discussed crucial winter ranges, said they prefer livestock grazing, aerial shooting of predators, oil and gas development, rights-of-way construction and range improvement construction to continue at present levels. Slightly more than one-half said that the BLM should acquire additional crucial winter range through trade or purchase as it becomes available. Ranchers were more likely to favor current management practices.

Responses of individuals who discussed oil and gas development in high potential areas were divided. Approximately one-third of the respondents said development should be restricted to protect crucial winter ranges for wildlife; about two-thirds said development should not be restricted. About two-fifths felt oil and gas development in high potential areas should be restricted in riparian habitat and piping plover habitat, with the same number saying it should not be restricted. More than one-half said oil and gas development should be restricted in high potential areas to protect cultural and paleontological resources.

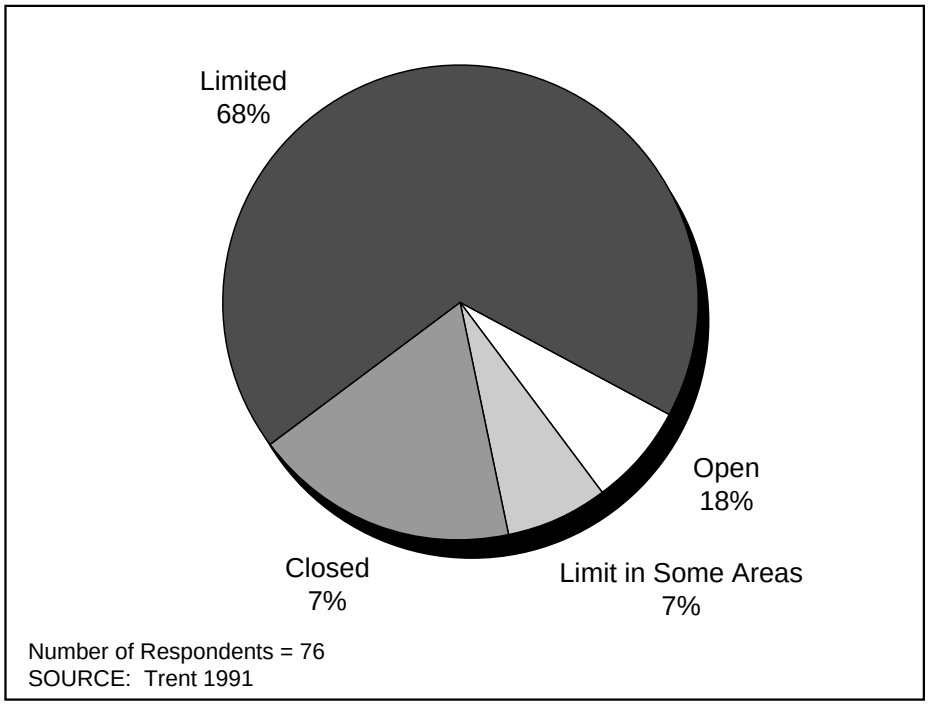
Responses of individuals who discussed black-footed ferret reintroduction were divided. More than one-half of the respondents support making land available for black-footed ferret reintroduction. Those who felt land should be made available, said it is important to preserve species and black-footed ferrets to control prairie dogs. Those who felt land should not be made available indicated a concern about prairie dogs and how they destroy land. If reintroduction should occur, respondents said recreational shooting of prairie dogs should be allowed. Nearly three-fourths felt prairie dog populations should be managed at their present level, limited or reduced. Fewer than one-third said BLM should acquire additional land in the black-footed ferret reintroduction area.

Respondents discussing the Fallon County sanitary landfill had divided responses. Forty-two percent said BLM should transfer the 640 acres to the county through exchange. Twenty-seven percent said the application should be rejected, 15 percent said BLM should sell all or part of the 160 acres to the county, and 6 percent said the land should be sold or transferred to the county. Reasons for accepting the proposal were that the county needs the site for a landfill, and the proposal would promote economic development. Reasons for rejecting the proposal included a need for more information and a study to make sure the site would be safe. These respondents also indicated that Montana should not be a garbage dump for other states.

About one-half of the respondents who discussed the transfer of land next to Makoshika State Park felt BLM should develop a cooperative agreement with Montana Department of Fish, Wildlife and Parks. One-fourth felt BLM should transfer the land to Montana Department of Fish, Wildlife, and Parks; and less than one-fifth said BLM should reject the proposal and continue current multiple-use management. Those supporting joint management felt it would increase recreational opportunities. Some respondents fear the loss of multiple-use management and livestock grazing.

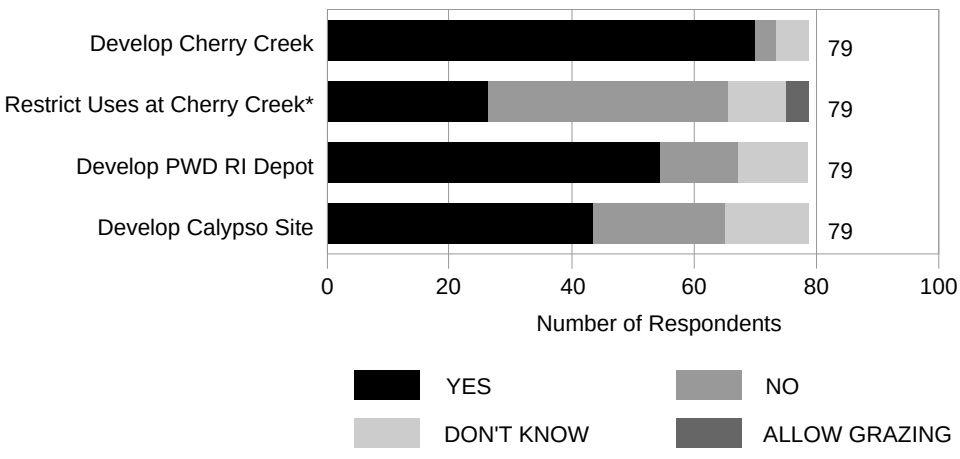
Respondents discussing paleontological and cultural site management said some present activities (oil and gas, and

FIGURE 6
OFF-ROAD VEHICLE USE MANAGEMENT



Number of Respondents = 76
SOURCE: Trent 1991

FIGURE 7
MANAGEMENT OF RECRATION AREAS



PWD RI = Powder River
*Uses other than recreation at Cherry Creek
SOURCE: Trent 1991

other minerals development, and rights-of-way) should be limited when necessary, or excluded. They prefer not to exclude recreation or livestock grazing in cultural areas. More than one-half said BLM should acquire additional land with paleontological or cultural values by purchase or trade.

ECONOMIC CONDITIONS

The economy of the planning area depends on natural resources. These include the land that is used for crops and livestock production, mining, oil and gas production; and the water and wildlife that offers recreational opportunities. Many of the economic sectors are directly related to the production, extraction, or use of natural resources, many of which are located on public lands in the planning area. This generates income and employment the most commonly used measure of economic well-being. Employment and earnings data focus on the 10 counties entirely within the planning area. Rosebud and Custer counties and Miles City were not included as they are not located entirely within the planning area.

Employment and Income

The number of jobs was 25,235 in 1988, down 18 percent from a peak of 30,850 in 1981 (see table 17). Three counties (Dawson, Richland, and Roosevelt) accounted for 64 percent of the jobs in 1988, down from 66 percent in 1981. Regional trade centers are Glendive in Dawson County, Sidney in Richland County, and Wolf Point in Roosevelt County. Jobs include proprietors and wage and salary employment (see table 18).

TABLE 17
TOTAL JOBS

County	1969	1979	1981	1988
Daniels	1,620	1,517	1,512	1,410
Dawson	5,405	6,385	7,020	5,349
Fallon	1,774	2,116	2,123	1,659
Garfield	961	878	868	873
McCone	1,488	1,462	1,370	1,273
Prairie	848	907	813	768
Richland	4,382	6,376	8,313	5,758
Roosevelt	4,621	5,025	5,128	5,163
Sheridan	2,631	2,879	3,016	2,364
Wibaux	681	699	687	618
Total	24,411	28,244	30,850	25,235

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis (BEA) 1989.

TABLE 18
1988 EMPLOYMENT

County	Wage & Salary	Proprietors	
		Farm	Nonfarm
Daniels	803	369	238
Dawson	3,904	451	994
Fallon	1,085	270	304
Garfield	496	222	155
McCone	712	342	219
Prairie	432	156	180
Richland	4,065	519	1,174
Roosevelt	3,809	562	792
Sheridan	1,547	530	287
Wibaux	270	181	167
Total	17,123	3,602	4,510

SOURCE: U.S. Department of Commerce, BEA 1989.

Wage and salary employment was 68 percent of the total in 1988, down from 75 percent in 1981. The statewide average for 1988 was 75 percent. The decrease in wage and salary employment was due primarily to the reduction in oil and gas and related activities (see table 19). Employment in most of the nongovernment sectors (mining, construction, wholesale and retail trade) declined significantly.

TABLE 19
WAGE AND SALARY EMPLOYMENT

	1981	1988
Nongovernment Sectors		
Agriculture	249	345
Mining and oil & gas	4,046	1,043
Construction	1,758	1,081
Manufacturing	828	1,070
Transportation & public utilities	2,250	1,629
Wholesale trade	1,217	820
Retail trade	4,732	3,788
Finance insurance & real estate	1,203	1,202
Services	5,114	5,024
Subtotal	21,397	16,002
Government		
State & local	3,089	3,381
Federal	787	902
Subtotal	3,876	4,283
Total	25,273	20,285

SOURCE: U.S. Department of Commerce, BEA 1990.

Total personal income is the most comprehensive measure of income in an area. Total personal income includes wages and salaries; employee benefits; proprietors; property income (interest, dividends, and rent); and government transfer payments (social security, medical payments, and unemployment insurance).

Total personal income in 1981 was influenced by two major factors: nonfarm and farm earnings (see table 20). The peak in nonfarm earnings was related to oil and gas exploration. The fall in oil and gas prices and exploration, with the steady decline in farm earnings between 1981 and 1985, resulted in a 20 percent decrease in total personal income over the period. Farm earnings rebounded in 1986 and more than offset the continued decline in nonfarm earnings.

Conditions by Economic Sector

Following is a discussion of the economic sectors most directly affected or dependent on the management of the federally-owned resources in the planning area.

AGRICULTURE

Most of the agricultural operators raise livestock and grain. Over the years, the typical farm has become larger, more mechanized, and more efficient. Statewide from 1950 to 1989, the number of farms has decreased by one-third; however, the average farm has increased by 2,453 acres, or 40 percent. The farmland acreage has decreased by 4.4 million acres, or 7 percent.

Agriculture accounted for 9 percent of the total jobs in Montana in 1986, down from 14 percent in 1969 (State of Montana, Department of Commerce 1989). In this area, agriculture accounted for 15 percent of the total jobs in 1988. This includes farm proprietors and agricultural services (farm management, contract labor, crop dusting and spraying, storage, and shipping). Major agricultural crops are wheat, barley and oats. Government payments and cash receipts for livestock and crops marketed in 1987 are shown in table 21. Richland County ranked tenth in the state in cash receipts, excluding government payments.

TABLE 20
INCOME AND EARNINGS (Thousands of Dollars)

	1979	1981	1983	1985	1986
Transfer Payments	176,932	203,087	248,739	229,730	241,485
Nonfarm Earnings	418,152	481,419	396,605	382,671	348,446
Farm Earnings	40,559	87,541	10,892	4,011	77,563
Total Personal Income	635,643	772,047	656,236	616,412	667,494

SOURCE: State of Montana, Department of Commerce 1989.

TABLE 21
1987 CASH RECEIPTS (Thousands of Dollars)

County	Livestock& Products	Crops	Marketing Total	Gov't Payments	All Cash Receipts
Daniels	4,479	10,392	14,871	11,176	26,047
Dawson	10,108	13,144	23,252	7,935	31,187
Fallon	10,067	4,237	14,304	4,380	18,684
Garfield	16,448	6,074	22,522	6,003	28,525
McCone	6,769	12,565	19,334	10,568	29,902
Prairie	11,286	5,326	16,612	2,930	19,542
Richland	18,129	26,521	44,650	9,406	54,056
Roosevelt	4,981	17,438	22,419	12,317	34,736
Sheridan	4,645	12,259	16,904	15,027	31,931
Wibaux	4,369	2,537	6,906	3,020	9,926
Total	91,281	110,493	201,774	82,762	284,536
State Totals	884,173	587,140	1,471,313	352,330	1,823,643
Percent of State Total	10	19	14	23	16

SOURCE: State of Montana, Department of Agriculture 1989.

In 1988, about 9 percent of the area's total acreage was harvested for crops (see table 22). Most of the marginal cropland under cultivation during the Homestead Era was returned to grazing, either through the Bankhead-Jones Act of 1937 or by economic constraints. The Bankhead-Jones Act of 1937 provided for the government to buy marginal farms and return them to grazing.

TABLE 22
HARVESTED CROP ACREAGE FOR 1988

County	Total Acres	Irrigated Acres	Nonirrigated Acres	Total Harvest Acres
Daniels	913,572	1,500	171,500	173,000
Dawson	1,519,846	16,340	149,500	165,840
Fallon	1,044,814	3,900	44,900	48,800
Garfield	2,875,160	6,900	113,900	120,000
McCone	1,681,178	7,400	196,600	204,000
Prairie	1,108,835	14,950	29,000	43,950
Richland	1,332,266	46,000	149,600	195,600
Roosevelt	1,508,963	12,520	246,400	258,920
Sheridan	1,076,184	4,930	272,800	277,730
Wibaux	568,502	2,900	44,200	47,100
Total	13,629,320	117,340	1,418,400	1,534,940

SOURCE: State of Montana, Department of Agriculture 1989; and USDI, BLM 1989a.

In the early 1980s, some grazing land was broken up for wheat production. As a result, the federal government introduced the Conservation Reserve Program in the Food Security Act of 1985. This program pays farmers to reseed marginal cropland to grass and leave it idle for 10 years; each county has a quota. Some farmers are putting land into the Conservation Reserve Program while others are breaking up and planting more land. Whether or not the Conservation Reserve Program will have any affect on crop production in this area is difficult to determine now.

The BLM's relationship to the agricultural economy of the area involves the leasing of the public lands for livestock grazing. Table 23 shows the sheep and cattle inventory for each county in the area for 1988.

TABLE 23
LIVESTOCK INVENTORY
(January 1, 1988)

County	Sheep	Cattle & Calves
Daniels	1,800	13,000
Dawson	3,400	34,000
Fallon	6,400	36,000
Garfield	68,300	49,000
McCone	16,000	29,000
Prairie	3,600	36,000
Richland	5,900	39,700
Roosevelt	6,500	19,000
Sheridan	5,000	16,500
Wibaux	2,700	18,500
Total	119,600	290,700
State Total	503,000	2,350,000

SOURCE: State of Montana, Department of Agriculture 1989.

COAL

The Fort Union Coal Region contains lignite. Estimates range up to 19 billion tons, in coal beds up to 40 feet thick. Coal characteristics and thickness are highly variable. The heating values range from about 5,000 to 7,500 British thermal units per pound. Ash and sulfur values are variable over such a large area, but as is typical with Montana coal, the sulfur content generally remains low. In 1958, Montana-Dakota Utilities at Sidney, Montana, began using coal for electricity generation. The Knife River Coal Company at Savage, Montana, reached a maximum production of 300,000 tons per year by 1965. The Savage Mine is the only active coal mine in the area, and produced 283,000 tons in 1991. It has provided income and jobs for more than 30 years. Although coal production has not played a significant role in the economy to date, the potential is there if these vast resources should ever be tapped.

OIL AND GAS

More than 170 oil fields in this area produced more than 15 million barrels of oil in 1989. This was 70 percent of Montana's total production (see table 24).

TABLE 24
1989 OIL FIELD PRODUCTION

County	Oil (barrels)	Gas (thousand) cubic feet)	Gas Liquids (gallons)
Daniels	0	0	0
Dawson	454,321	13,459	0
Fallon	3,472,483	1,144,430	158,227
Garfield	78,542	0	0
McCone	62,833	0	0
Prairie	60,381	344	0
Richland	3,900,941	1,923,944	3,756,499
Roosevelt	1,730,288	496,749	439,486
Sheridan	2,638,477	1,079,949	166,161
Wibaux	1,103,393	79,177	0
Total	13,501,659	4,738,052	4,520,373
State Total	21,998,880	42,870,343	5,323,401

SOURCE: State of Montana, Department of Revenue n.d.

The income and employment generated by the oil and gas exploration and production activities have a significant impact on the area's economy. Wages and salaries paid by the industry are higher than the statewide averages for all industries. The average earnings were $27,146 in 1988, compared to an average of $16,958 for other economic sectors (State of Montana, Department of Labor and Industry 1988). The timing, size, and duration of oil and gas activity are determined by price fluctuations. The "boom and bust" cycles tend to be more abrupt than other resource developments.

WHOLESALE AND RETAIL TRADE AND SERVICES

Trade and service sectors provide substantial employment: 9,632 jobs (47 percent) of the wage and salary employment for 1988. Wholesale trade is important in Wolf Point, Sidney, and Glendive, Montana. Jobs and income in these sectors depend on the health of other industry sectors (principally, agriculture and oil and gas extraction). In addition, many of the jobs associated with recreation and tourism are included in these sectors.

GOVERNMENT

In 1988, government provided 4,283 jobs (21 percent) of the total wages and salaries in the area. This was an increase of 407 government jobs (10.5 percent) since 1981. Government employment increased an average of 1.2 percent per year from 1981 to 1988. Local government, which includes the public school districts, is the largest employer. State and federal jobs provide salaries above the area's average and are important to the regional economy.

Local Government Revenues

PROPERTY TAX

Property taxes are the principal source of revenue in this area. Property tax liability is based on market value, statutory tax rates, and local mill levies. Each county's total taxable value is shown in table 25.

TABLE 25
1988 TAXABLE VALUES

County	Dollar Amount
Daniels	6,608,820
Dawson	22,395,861
Fallon	70,173,645
Garfield	6,568,235
McCone	8,544,826
Prairie	4,329,250
Richland	66,414,381
Roosevelt	44,533,497
Sheridan	38,804,161
Wibaux	16,700,971
Total	285,073,647

SOURCE: State of Montana, Department of Revenue n.d.

BLM'S CONTRIBUTION TO LOCAL REVENUE

The BLM's principal contribution to the taxable value of the counties is based on the value of the production of federal oil, gas, and coal. The BLM also administers other programs resulting in disbursements to local governments. Major sources of these revenues are federal mineral leases, grazing leases, and payment in lieu of taxes payments.

GRAZING FEES

The Taylor Grazing Act of 1934 stipulates that states receive a 12.5 percent share of grazing fees collected inside grazing districts (Section 3 payments). The states also receive a 50 percent share of grazing fees collected outside organized grazing districts (Section 15 payments). Under the law, each state's legislature decides how to spend the

money for the benefit of the counties. Payments disbursed to the counties for fiscal year 1988 are shown in table 26.

TABLE 26
GRAZING FEE PAYMENTS
FISCAL YEAR 1988

County	Section 15 Payments Dollar Amount	Section 3 Payments Dollar Amount
Daniels	39	0
Dawson	0	17,082
Fallon	0	19,510
Garfield	0	156,295
McCone	0	63,474
Prairie	0	15,383
Richland	23,764	0
Roosevelt	1,914	0
Sheridan	99	0
Wibaux	10,699	0
Total	36,515	271,744

SOURCE: USDI, BLM 1991c.

PAYMENTS IN LIEU OF TAXES

The federal government makes payments to counties in lieu of taxes for certain federal lands. The amount is calculated by using two formulas, and the larger of the two is the amount given to the county. Table 27 shows the amount of payments in lieu of taxes payments for each county in this area for fiscal year 1989. Funding for payments in lieu of taxes must be appropriated by Congress each year. Actual amounts paid to counties are based on the funding level and the amount calculated.

TABLE 27
PAYMENTS IN LIEU OF TAXES
(Fiscal Year 1989)

County	Dollar Amount
Daniels	143
Dawson	49,412
Fallon	72,764
Garfield	81,597
McCone	132,919
Prairie	42,866
Richland	36,294
Roosevelt	2,880
Sheridan	1,021
Wibaux	18,743

SOURCE: USDI, BLM 1989a.

MINERAL RECEIPTS

The Mineral Leasing Act of 1920, as amended, provides that one-half of the bonuses, rents, and royalties derived from federal mineral leases be returned to the state and counties for stated purposes. Federal oil and gas disbursements for fiscal year 1989 (October 1, 1988 to September 30, 1989) are shown in table 28.

TABLE 28
FEDERAL OIL AND GAS DISBURSEMENTS
FISCAL YEAR 1989

County	Dollar Amount
Daniels	4,144
Dawson	203,492
Fallon	1,524,526
Garfield	95,192
McCone	24,475
Prairie	103,658
Richland[1]	425,497
Roosevelt	21,228
Sheridan	29,310
Wibaux	287,789

SOURCE: USDI, Minerals Management Service 1989.
[1]Includes $165,550 for one producing federal coal lease.

SOIL AND WATER

SOILS

Soils in this area result from soft, sedimentary bedrock (sandstone, siltstone, shale), local and regional alluvium, and a small amount of glacial till. The complex and diverse soil patterns vary in character and productivity. The Soil Conservation Service has published soil surveys for Daniels, Dawson, McCone, Richland, Roosevelt, and Sheridan counties. Soil surveys nearing completion cover Custer, Fallon, Garfield, Prairie, and Rosebud counties. An Order III soil survey of BLM-administered lands in Custer, Fallon, Garfield, Prairie, and Rosebud counties was completed in 1980. This survey grouped the soils into 15 subgroups. Each subgroup has unique capabilities and limitations based upon parent material, climate, topography, and soil properties. The unpublished legends, maps, and descriptions relevant to the Order III soil survey are at the Big Dry Resource Area Office in Miles City.

DISSECTED SEDIMENTARY PLAINS AND HILLS- These soils are found on level to steep (0-45 percent) slopes and on sedimentary bedrock plains and hills (soil subgroups 3, 4, 8, 9, 12, and 13). Soil depths range from shallow to deep, and have low to high water and wind erosion susceptibility. Soil textures are clayey, loamy and sandy, and are formed in shale, siltstone, and sandstone.

FLOODPLAINS, FANS, AND LOW TERRACES - These soils are located in riparian/wetland areas on level to rolling (0-15 percent) slopes along the major floodplains and streams. They are important because of their high production potential. The soil textures, depth and chemical properties are highly variable over short distances. These riparian/wetland soils usually are water-saturated in the spring. Water is lost through evaporation and growing plants. These riparian/wetlands produce abundant forage, and provide access to water and shade. Most riparian/wetland soils occur within soil subgroup 1.

GLACIATED TILL PLAINS - These soils are located on level to rolling and steep (0-45 percent) slopes of the glacial till plains in the northeast part of the planning area. Soil textures are mainly loamy and clayey. Erosion of these soils is slight to moderate because of the gently rolling topography with the prominence of dense clubmoss and blue grama sod in many areas. Mechanical treatment of these soils can increase vegetative productivity (soil subgroups 5, 6, and 10).

SOILS ON FANS, BENCHES, AND TERRACES - These soils are found on level to steep (0-45 percent) slopes on fans, benches, and terraces close to the rivers. Soil textures are mainly loamy and sandy, and have formed in an alluvium. There is moderate water-erosion and high wind-erosion hazard (soil subgroups 2, 7, and 11).

DISSECTED SHALE PLAINS - These soils occur on level to steep (0-45 percent) slopes on dissected shale plains in the southwestern portion of the planning area. Soil texture is predominantly clayey; there is moderate to high water-erosion (soil subgroup 14).

DISSECTED BADLAND AREAS - These soils are located on steep (25-70 percent) slopes of dissected breaks along the rivers. Soil textures are predominantly loamy and clayey. Because of properties such as high clay content, reduced permeability, rapid surface runoff, and sparse vegetative cover, these soils are fragile and extremely erosive (soil subgroup 15).

WATER

GROUND WATER

Quaternary alluvium is located along the major streams and rivers and contains the shallowest aquifers. The yield of water may range from 1 gallon per minute in the areas of fine-grained valley fill to several hundred gallons per minute along the rivers where material is coarse. Water quality depends on the soil materials and the water source; depth ranges from a few feet to 50 feet. Along the upper benches of the Yellowstone River from Custer County to North Dakota, and along the Redwater River-Yellowstone River divide, the alluvial gravel deposits produce yields of 1 gallon per minute up to 20 gallons per minute. Less than 2 gallons per minute is too low for use. Gravel deposits produce springs at the interface of the underlying geologic formations (the Lebo and the Tongue River members). The yields vary from a few gallons per day to more than 80 gallons per minute. The water is adequate for livestock and domestic uses.

The availability of ground water is related to the geologic formations that are sedimentary in nature. The Fort Union, the Hell Creek, and Fox Hills formations provide aquifer systems (see figure 8). The Fort Union Formation consists of the Tongue River, Lebo, and Tullock members (USDI, BLM 1982b). Wells range from 50 to 500 feet in depth. The Tongue River Member is the most widely used.

The Lebo Member is exposed along major drainages, the Cedar Creek anticline, and the Porcupine dome area. The Tullock Member is exposed in a similar way. The Lebo Member is generally not capable of producing water of adequate quantity and quality for livestock and domestic purposes. The Tullock and the Ludlow members contain aquifers that will supply 6 to 15 gallons per minute of water that is suitable for livestock use.

The Hell Creek Formation has aquifers that supply water of adequate quantity and quality for livestock and domestic use. The Hell Creek Formation surfaces along the Musselshell River, Cedar Creek anticline, Missouri River, and the Porcupine dome areas. Water depth here is 100 to 300 feet, although the remainder of the area has a water depth of 400 to 600 feet due to the overlying Fort Union Formation.

The best quality water in the planning area is located in the lower part of the Hell Creek Formation and upper part of the Fox Hills Formation. The aquifer is 30 to 60 feet wide and produces 30 to 100 gallons per minute. Water depth in the northern part is as shallow as 40 feet, but reaches a depth of 1,800 feet where the Tongue River Member of the Fort

Union Formation is in place. The aquifer is under artesian pressure and will flow at the surface in the river and stream valleys.

The Bearpaw Formation does not contain an aquifer. This formation (which surfaces along the Missouri River Valley and along the Porcupine dome area) has a depth of approximately 1,000 feet which prevents the development of wells. Springs occur at the contact point of the sandy Fox Hills and the shaley Bearpaw formations with yields adequate for livestock and wildlife. However, the water quality is poor (measuring 12,000 milligrams per liter of total dissolved solids), barely adequate for animal use, and livestock deaths have resulted from using this water.

The South Pine Creek Groundwater Control Area (see map 19) is located along the western portion of the Cedar Creek anticline on the eastern edge of Prairie County. The area was established in 1967 by the Board of Natural Resources and Conservation for protecting the rights of existing water users and controlling the decline in the water level of the Fox Hills-Hell Creek aquifer. The main objective was control of the withdrawals for secondary oil recovery. In 1981, the ground water control area had shown a progressive rise in the static water level over the previous 4 to 5 years. The only areas continuing to decline were the southeast quarter of T. 12 N., R. 55 E., and the northwest quarter of T. 11 N., R. 55 E. This decline was due to domestic and stock wells, and to a lack of conservation measures such as uncapped wells flowing freely (Rediske 1981).

SURFACE WATER

The Missouri and Yellowstone rivers are the major drainages in the planning area. The Missouri River drains the northern portion of the planning area and flows east, with an average annual discharge of 7.8 million acre-feet. Tributaries of the Missouri River include the Musselshell River with an average annual discharge of 206,500 acre-feet; Big Dry Creek with an annual average discharge of 38,180 acre-feet; and Redwater River with an annual yield of 9,420 acre-feet. The Yellowstone River drains the southern and eastern portion and flows northeast. The average discharge is 9.3 million acre-feet per year. Tributaries of the Yellowstone River include the Powder River that discharges an annual average of 431,800 acre-feet and O'Fallon Creek that has an annual measured discharge of 12,900 acre-feet (Shields et al. 1988).

The lower end of Fox Creek in Richland County is the only known perennial creek in the area; remaining creeks are intermittent or ephemeral. The streams are semi-arid and provide a highly-variable streamflow. Peak flows generally occur March through May, resulting from melting snow and rainfall. Intense flows of short duration occur throughout the summer following thunderstorms. There are 150 miles of major intermittent streams with about 960 reservoirs on the public lands in this area. Total dissolved solids in these streams are generally high enough to prevent human consumption (Montana Testing Labs 1981). Standing water is beneficial for wildlife. There are 2,836 miles (10,000 acres) of potential riparian/wetlands along the floodplains of the intermittent streams in this area.

Water quality of streams is affected by leaching of soluble minerals from the surface soils and from the aquifers underlying the drainage basin. The dissolved solids are composed largely of the cations (calcium, magnesium, and sodium), and the anions (bicarbonate, sulfate, and chloride). During base (or low) flows, water primarily comes from ground water sources and has a high concentration of dissolved solids because of long-term contact with minerals in the aquifers. Concentrations ranging from 1,000 to 3,000 mg/l are common, and may exceed 5,000 milligrams per liter. The water reflects the type and quantity of minerals in the aquifer from which it was derived. The ions present during base flow are generally sodium and sulfate (Slagle 1984).

During direct (or high) flows, most of the water entering the streams is from recent precipitation runoff. Runoff water quickly enters the stream channels and is in contact with the soils for a short time, allowing little opportunity for the minerals to leach out of the soil. The result is a dilution of the mineral concentrations normally carried by the base flow. Concentrations of dissolved solids during direct flows generally range from 150 to 600 milligrams per liter. The ion concentrations during high flows tend to have more calcium and bicarbonate, but usually does not exceed the sodium and sulfate found during base flow (Slagle 1984).

Streams draining into the Yellowstone River have a high concentration of magnesium; streams draining into the Missouri have a high percentage of sodium. Chloride is found in small amounts in any size streamflow (Slagle 1984), but is found in large quantities in waste water associated with oil and gas production. Chloride can be sampled as part of the base flow in streams near producing oil fields, especially Pennel Creek. Average annual runoff in this area is about 1/2 inch. Stream water is suitable for irrigation during moderate to high flows from melting snow or spring rains.

Waters of the Yellowstone and Missouri are good for wildlife, domestic, stock, and irrigation uses. The Musselshell River is marginal for domestic and irrigation uses, but satisfactory for livestock and wildlife. The Powder River is high in total dissolved solids and suspended sediment; rates good for wildlife, fair to good for livestock and is unsatisfactory for other uses (USDI, BLM 1982b).

Hydrologists from the Bureau of Reclamation estimate the average water yield of the drainage at the Cherry Creek dam site to be 4,900 acre-feet per year. This estimate comes from a comparison of the runoff from four gaged drainages: Burns Creek, Pumpkin Creek, Mizpah Creek, and Redwater River. Figure 9 shows the estimated runoff from 1973 to 1985. The Bureau of Reclamation used a computer model to synthesize the stream flow data and working parameters at the different reservoir locations. Estimated water yields for the Cherry Creek Reservoir exceed contributed runoff by approximately 2,265 acre-feet annually. The additional amount of water needed may be obtained for this project, through the conversion of water reservations held by BLM, to water rights. Sediment yields from the drainage were estimated at 104 acre-feet. Although the size of the Cherry Creek drainage is only .5 percent to .6 percent of the Yellowstone River drainage, the sediment yield is 1.0 to 1.8 percent of the total sediment of the river. BLM will consider requesting water from Yellowtail Dam. This would increase the flow of the Yellowstone River an estimated .02 to .60 percent.

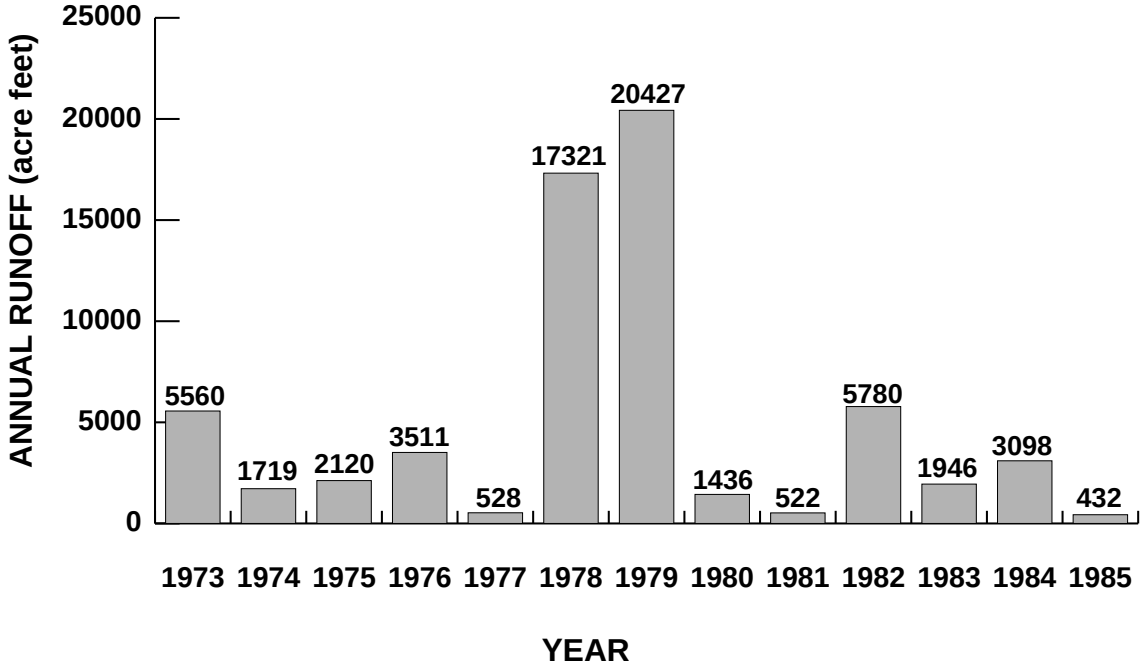
WATER RIGHTS

Some BLM water rights are protected by the Federally Reserved Water Rights for Public Springs and Water Holes, Public Water Reserve 107, pursuant to Executive Order dated April 17, 1926. Water rights adjudication began in Montana in the late 1970s. BLM water rights are filed in compliance with the state of Montana. This includes filing on new developments, transferring rights, abandoning rights, proof of pre- and post-1973 filings, and filing on any disputes.

Developments include springs, wells, reservoirs, pits, and natural potholes. In some cases, instream water was filed for livestock and wildlife use. Those called pre-1973 developments total 1,418; post-1973 developments total 416 filings. Proof of the date of development is required on filings. Based on that proof by the state of Montana, present and past water rights are being adjudicated by basin. This area has 13 water rights basins; 8 are in the preliminary stage. Five basins have been adjudicated, two of which could be reopened because of disputes.

In December 1990, the BLM filed for water rights for the Cherry Creek Dam. The BLM is considering the feasibility of obtaining 2,380 acre-feet of water annually from Yellowtail Dam for supplementing the flow from Cherry Creek. If possible, the water would be pumped from the Yellowstone River after it is released from Yellowtail Dam.

FIGURE 9
ESTIMATED TOTAL ANNUAL RUNOFF
CHERRY CREEK DRAINAGE



VEGETATION

Vegetation protects the soils, stabilizes the watershed and riparian/wetlands, and provides forage for livestock as well as for wildlife. Vegetative types on the public lands in the planning area include grasslands (47 percent), badlands and river breaks (22 percent), sagebrush grasslands (21 percent), forestlands (3 percent), tame grass (3 percent), broadleaf trees, and mesic-shrubs (2 percent), and halophytic shrubs (2 percent) (USDI, BLM 1979a, 1982b).

Grasslands are dominated by short to mid-grasses with forbs making up a minor part. Common grasses are needleandthread, green needle, June grass, western wheatgrass, crested wheatgrass, and blue grass.

The vegetation in the badlands and river breaks are mixed and include grassland, sagebrush, juniper, limber and ponderosa pine.

Sagebrush grasslands consist of big sagebrush and silver sagebrush, with mixed grasses and forbs. However, sagebrush makes up more than 25 percent of the total species composition in these grasslands.

Forestlands are dominated by ponderosa pine, although meadows of herbaceous vegetation are interspersed with ponderosa pine.

Tame vegetation refers to that vegetation not native to the area. This vegetation had been planted for forage production and soil stabilization. Most of these plantings are crested wheatgrass.

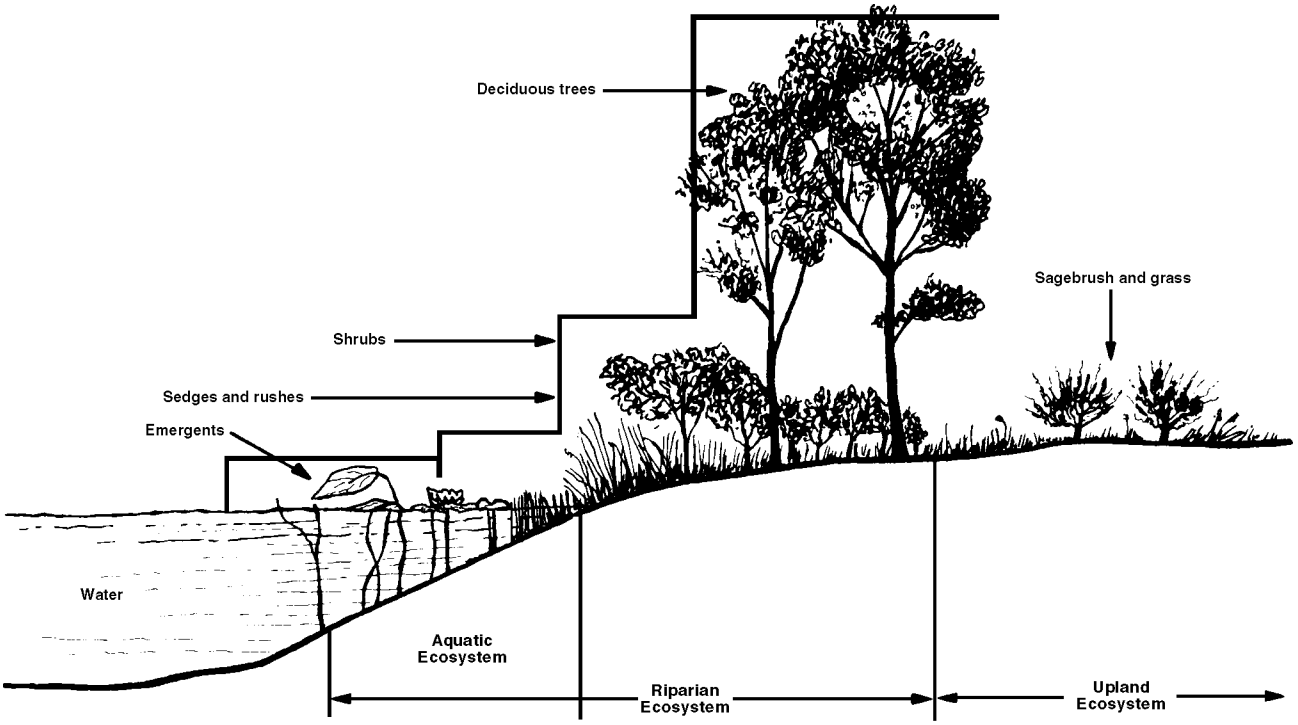
Another vegetation type is broadleaf and mesic shrubs, consisting of cottonwoods, willows, green ash, snowberry, chokecherry, and buffaloberry. They are extremely diverse and thrive in areas receiving abundant moisture from runoff to subsurface springs or in drainage bottoms.

A halophytic shrub is a type of vegetation that occurs in areas where salt and alkali gather. Greasewood and saltbush are common shrubs; saltgrass and alkali sacaton are common grasses.

Riparian/Wetlands

Riparian/wetlands overlap with broadleaf trees and mesic shrub communities and are interspersed within other vegetative communities (see figure 10). A riparian/wetlands

FIGURE 10
AQUATIC-RIPARIAN-UPLAND ECOSYSTEMS



Source: Modified from Thomas et al. 1979.

area is defined as land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of permanent water influence. Lakeshores and stream banks are typical riparian/wetlands. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil. In Montana, the definition is further interpreted to include areas that have the potential to meet the definition.

The benefits of riparian/wetlands exceed the small area they occupy. Trees and other woody vegetation are highly valued in the prairie environment, for they provide many benefits to animals. The planning area contains 150 miles of major intermittent streams with about 960 reservoirs on public lands. There are 2,836 miles (10,000 acres) of potential riparian/wetlands along the floodplains of the ephemeral streams in this area. There are 21 major and 5 minor riparian/wetland habitat types involved; more than 25 community types make up the various seral stages for them. Table 75 in the Vegetation appendix contains a complete listing of the riparian/wetlands habitat and community types in the planning area. The areas range from the major rivers such as the Yellowstone and Missouri rivers, to woody draws with water available. Due to the scattered land pattern, many of these areas are not manageable without commitment from landowners on adjacent property.

Special Status Plant Species

The U.S. Fish and Wildlife Service has not listed any plants as threatened or endangered in Montana. There are 13 plant species that may be considered for special status, but more information is needed to list or delist. The BLM has contracted with the Montana Natural Heritage Program to

TABLE 29
SPECIAL STATUS SPECIES

Scientific Name	Common Name	USFWS Status	Rareness Codes Global/State
Species That May Be Considered			
Ammania coccinea	scarlet ammania	-	G5/S1
Aster ptarmicoides	prairie aster	-	G5/S1
Astragalus racemosus	alkali milkvetch	-	G5/S1
A. barrii	barr milkvetch	C2	G3/S2
A. geyeri	geyer milkvetch	-	G5/S1
Bidens comosa	begger-ticks	-	G5/S1
Bidens vulgata var. schizantha	tall begger-ticks	-	G5/S1
Celastrus scandens	bittersweet	-	G5/S1
Cyperus schweinitzii	schweinitz faltsedge	-	G5/S1
Linaria Canadensis	blue toadflax	-	G4G5/S1
Mentzelia nuda	bractless blazing star	-	G5/SU
Phacelia thermalis	hotspring phacelia	-	G3G4/S1
Ririppa calycina	persistent sepal yellowcress	-	G5/S1

SOURCE: Lesica and Shelly 1991.

C2 means a plant is a candidate for the U.S. Fish and Wildlife Service listing as threatened and endangered, but more information is needed to list or delist.

G3 means either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction throughout its range because of other factors; in the range of 21 to 100 occurrences.

G4 means The Nature Conservancy feels a plant is apparently globally secure.

G5 means The Nature Conservancy, of which the Montana Natural Heritage Program is a part, considers the plant demonstrably globally secure. Globally secure, by The Nature Conservancy's definition, means there is no danger of the plant becoming extinct in the world, but is sensitive in Montana.

S1 means critically imperiled in Montana because of extreme rarity (5 or fewer occurrences, or very few remaining individuals), or because of some factor of its biology making it especially vulnerable to extirpation from the state.

SU means possibly in peril in Montana, but status uncertain; more information needed.

gather information needed to determine the status of the species. Global and state rareness codes based on current information are shown in table 29 for plants that may be found in the planning area.

Noxious Weeds

Noxious weeds (see map 21) occur in any vegetative type or ecological seral stage. Leafy spurge is the dominant species (4,500 acres) in the planning area. Leafy spurge is a perennial that creates serious problems because it spreads rapidly and is extremely difficult to eradicate once established. Other noxious weeds infesting the public lands are knapweed species (spotted, diffuse, and Russian), hoary cress (whitetop), field bindweed, Canada thistle, houndstongue, and cocklebur. An isolated patch of poisonous halogeton occurs occasionally in this area. Table 76 in the Vegetation appendix contains a list of Montana's noxious weeds.

The Big Dry Vegetation Allocation Environmental Impact Statement (USDI, BLM 1982b) states that noxious weeds invade ranges which are in excellent condition and displace useful forage. For example, leafy spurge can out compete native vegetation. If proper weed management programs are not implemented, noxious weeds will spread at a rate of 12 to 14 percent annually, depending upon the weed species present. Ultimately, the weeds could dominate the area, with a tendency to create a monoculture. Treatment efforts have not kept up with the increase in weeds.

Noxious weed control practices are consistent with the Northwest Area Noxious Weed Control Program Final Environmental Impact Statement (USDI, BLM 1985) and Supplemental Environmental Impact Statement (USDI, BLM 1987d) and the Final Environmental Impact Statement Vegetation Treatment on BLM Lands in Thirteen Western States (USDI, BLM 1991b).

Prime Farmland

The 13 counties in the planning area contain some prime farmland which is, by U. S. Department of Agriculture's definition, the land that is best suited for producing food, feed, forage, fiber, and oilseed crops. It has the soil quality, length of growing season, and moisture supply necessary to produce a sustained high yield of crops when properly managed. Prime farmland produces the highest yield with minimal energy and economic resources. It can be cultivated cropland, rangeland, or woodland, but does not include urban and built-up areas or water areas. To qualify as prime farmland, the land must be used either for producing food or fiber or be available for those uses. Prime farmland includes gently sloping upland areas, terraces, land adjacent to streams, and river valleys.

The following is prime farmland acreage by county (more than 80 percent is private):

Custer: Approximately 35,000 acres; exact acreage will not be available until soil survey is complete.

Daniels: 22,030 acres.

Dawson: 279,800 acres.

Fallon: 280,000 acres.

Garfield: Approximately 134,000 acres; exact acreage will not be available until soil survey is complete.

McCone: 133,945 acres.

Prairie: 34,960 acres.

Richland: 315,500 acres.

Roosevelt: 103,130 acres.

Rosebud: 85,000 acres.

Sheridan: 348,338 acres.

Valley: 306,650 acres.

Wibaux: 51,507 acres.

Condition, Production, and Trend

Vegetation condition is expressed as excellent, good, fair, poor, unclassified, or tame (see Vegetation appendix). It reflects the current vegetation composition of the rangeland in relation to the potential natural plant community. The range condition of the public lands in the planning area is 86 percent good to excellent, 8 percent fair, 1 percent poor, and 1.6 percent unclassified. The remaining 3.4 percent is tame (see table 52 in the Livestock Grazing Management appendix). This information was summarized from the Missouri Breaks Environmental Statement and Big Dry Environmental Impact Statement Vegetation Allocation and has been updated with monitoring data (USDI, BLM 1979a, 1982b).

The opportunity for improving vegetation conditions and production is greater on clayey or loamy sedimentary uplands, on alluvial terraces, and on floodplains. Silty and clayey soils are dominant, and are among the most productive and responsive. Vegetation production on the rangelands varies widely by soil type and range site, and is subject to effective precipitation (amount and season). Timing is critical as low precipitation during plant dormancy results in low production. Critical rainfall periods are the fall before freezing and the spring during early plant growth (USDI, BLM 1982b).

Trend is defined as the direction of change, over a period of time, in vegetation condition. The planning area shows a trend in a stable or slightly upward direction as indicated by a comparison of range surveys, and as shown by the amount of range in good or excellent condition (USDI, BLM 1982b).

WILDERNESS

Wilderness Study Areas

The wilderness study areas include Bridge Coulee, Musselshell Breaks, Billy Creek, Seven Blackfoot, and the Terry Badlands (see pocket maps 31A,B,C,D). The Final Missouri Breaks Wilderness Suitability Study and Environmental Impact Statement (USDI, BLM 1987a) contains detailed descriptions of the wilderness study areas' affected environments and the alternatives. The BLM's wilderness recommendations for these wilderness study areas are discussed in detail in Volume II of the Montana Statewide Wilderness Study Report (USDI, BLM 1991d). The following is a summary of the recommendations:

Acres Recommended for Wilderness

Seven Blackfoot	5,790
Terry Badlands	33,024

Seven Blackfoot Wilderness Study Area.

Acres Not Recommended for Wilderness

Bridge Coulee	5,900
Musselshell Breaks	8,650
Billy Creek	3,450
Seven Blackfoot	14,540
Terry Badlands	11,886

Monitoring will be conducted as described in table 58 of the Monitoring appendix.

WILDLIFE

Three agencies share responsibility for wildlife management on the public lands. The Montana Department of Fish, Wildlife and Parks manages the animals; the U.S. Fish and Wildlife Service is responsible for the coordination of threatened and endangered species habitat management; and the BLM manages the wildlife habitat. Although management of threatened and endangered species is a cooperative program among the Montana Department of Fish, Wildlife and Parks, U. S. Fish and Wildlife Service, BLM, other agencies, organizations, and interest groups, the BLM is responsible for the conservation of threatened and endangered species on the public lands.

Within the area, the diversity of wildlife habitat includes grasslands, grasslands-shrublands, badlands, ponderosa pine forests, woodlands, riparian/wetlands, and agricultural lands. Rivers, streams, potholes, cliffs, snags, springs, potholes, reservoirs, and islands provide food, nesting habitat, and cover for a variety of wildlife species. The greatest vegetative diversity generally is found in the riparian/wetlands.

Big Game

The planning area supports a variety of big game species. (See map 24 for crucial winter ranges.) Mule deer occupy 90 percent or more of the planning area and approximately 224,000 acres are mule deer crucial winter range (Martin 1990, Wentland 1990). The mule deer population peaked in the early 1980s, and then declined for 4 to 5 years as a result of drought, poor winter survival, and liberal harvests (Giddings 1993). Their numbers are now increasing.

In the spring, mule deer feed extensively on green grasses until forbs become available. Forbs, grasses, and browse are utilized from mid-spring through summer. The primary component of the mule deer's diet in the fall, winter, and early spring is browse which includes big and silver sagebrush, skunkbrush sumac, chokecherry, rubber rabbitbrush, western snowberry, and rose. Table 30 shows the plants most favored by Montana's deer. Basically nonmigratory, they concentrate on south and southwest facing slopes which contain important species of browse. In winters of heavy snowfall, these areas are crucial to the mule deer.

Escape and thermal cover also are important to mule deer for maintenance and survival. Doghair stands of ponderosa pine and juniper are examples of important escape and thermal cover. Without this cover, deer (especially fawns) are susceptible to predators and severe weather. Mule deer use this cover for loafing during the day.

White-tailed deer occupy 30 to 35 percent of the planning area (Martin 1990). The white-tailed deer prefer the drainage bottoms along the major streams and rivers, pine-covered hills, and the woody vegetation adjacent to croplands. The planning area has 2,836 miles of riparian/wetland bottoms, containing 10,000 acres of public lands of habitat (Griffith 1990). This public land is considered crucial white-tailed deer habitat. Their population remains relatively constant despite periodic outbreaks of Epizootic Hemorrhagic Disease, a noncontagious viral disease characterized by extensive hemorrhaging.

White-tailed deer food habitats are similar to the mule deer. In the spring green grasses are utilized until forbs appear. Forbs, grasses and browse are utilized from mid-spring through the summer; and alfalfa and grain crops from summer into the winter. Important browse from mid-fall through early spring includes big and silver sagebrush, chokecherry, rubber rabbit brush, western snowberry, buffaloberry and rose. Escape and thermal cover are also important to the white-tailed deer for survival.

Pronghorn antelope are the second most numerous big game animal in this area. Density averages two per square mile; however, large variations in density can occur (Ensign 1990). The Montana Department of Fish, Wildlife and Parks data indicates an increase in the antelope population from mid-1980s, probably due to mild winters. Antelope prefer the open, rolling grasslands and shrub-grassland in addition to agricultural vegetation in the spring, summer, and early fall. There are an estimated 236,800 acres of crucial winter range on the public lands in the planning area. Sagebrush constitutes a large part of their year-round forage and at least 80 percent of their winter diet (see table 31). Plants favored by antelope are listed in table 32. Vegetative cover is necessary for fawning as it protects the young from predators and weather.

TABLE 30
PLANTS UTILIZED BY DEER IN MONTANA

Browse	Forbs	Grasses
Big sagebrush	Alfalfa	Prairie June grass
Common juniper	American vetch	Sandberg bluegrass
Rabbit brush	Common bastard toadflax	Western wheatgrass
Rose	Common dandelion	Wheat
Snowberry	Hood's phlox	Barley
Chokecherry	Lomatium	
Silver buffalo berry	Prairie onion	
Skunkbush sumac	Summer cypress	
Willow	Prairiesmoke	
Cottonwood	Pussytoes	
Silver sagebrush	Sagebrush buttercup	
Redosier dogwood	Scarlet gaura	
Serviceberry	Yellow fritillary	
Plains poplar	Yellow salsify	
Winter fat	Yellow sweetclover	
Nuttall saltbush	Prickly lettuce	
Creeping juniper	Small soapweed	
	American licorice	
	Fringed sagewort	
	Wild buckwheat	
	Clover	
	Fireweed	

SOURCE: USDI, BLM 1981b.

TABLE 31
FOOD HABITATS OF ANTELOPE IN MONTANA

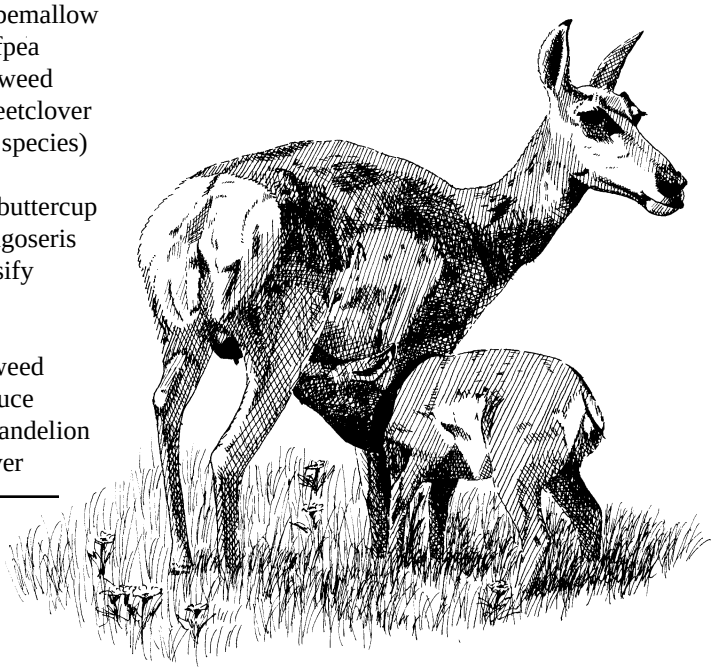
	Vegetative Preference		
Season	**First**	**Second**	**Third**
Spring	Browse (71%)	Forbs (21%)	Grass (8%)
Summer	Forbs (66%)	Browse (33%)	Grass (1%)
Fall	Browse (50%)	Forbs (48%)	Grass (2%)
Winter	Browse (98%)	Grass (1.5%)	Forbs (0.5%)

SOURCE: USDI, BLM 1981b.

TABLE 32
PLANTS FAVORED BY PRONGHORN ANTELOPE IN MONTANA

Browse	Forbs	Grasses
Big sagebrush	Common bastard toadflax	Bluegrass
Silver sagebrush	Western yarrow	Wheat
Greasewood	Hairy seed lomatium	Barley
Winterfat	Hood's phlox	Blue grama
Rabbitbrush	Knotweed	Brome grass
Rose	Cudweed sagewort	Wheatgrass
Skunkbrush sumac	Fringed sagewort	
Western snowberry	Scarlet globemallow	
Nuttall saltbrush	Silver scurfpea	
	Small soapweed	
	Yellow sweetclover	
	Thistle (all species)	
	Onion	
	Sagebrush buttercup	
	Wavyleaf agoseris	
	Yellow salsify	
	Alfalfa	
	Aster	
	Field bindweed	
	Prickly lettuce	
	Common dandelion	
	Prairie clover	

SOURCE: USDI, BLM 1981b.



The Rocky Mountain Elk is one of the most prized trophy animals in the United States. In this part of the country, elk are found in the rough breaks and pine-covered hills adjacent to the Charles M. Russell National Wildlife Refuge in Garfield County (Hildebrand 1990). The elk herd continues to increase. Habitat types crucial to the elk are grasslands, grasslands-shrub, woodlands, and riparian/wetlands. Elk habitat boundaries have not been defined. Vegetative preferences and food plants utilized by elk are shown in tables 33 and 34.

TABLE 33
VEGETATIVE PREFERENCES OF ELK

	Habitat Preference		
Season	**First**	**Second**	**Third**
Spring	Grass (90%)	Forbs (7%)	Browse (3%)
Summer	Forbs (91%)	Grass (6%)	Browse (3%)
Fall	Grass (83%)	Forbs (14%)	Browse (3%)
Winter	Grass (90%)	Browse (7%)	Forbs (3%)

SOURCE: Rouse 1957.

TABLE 34
PLANTS FAVORED BY ELK

Grasses	Forbs	Browse
Bluebunch wheatgrass	American vetch	Common chokecherry
Bluegrasses	Chicory lettuce	Rose
Canada bluegrass	Common bastard	Skunkbrush sumac
Green needlegrass	Toadflax	Snowberry
Idaho fescue	Common dandelion	Spiraea
Prairie June grass	Fringed sagewort	Whitestem currant
Rough fescue	Hairyseed lomatium	Big sagebrush
Sandberg bluegrass	Nodding microseris	Creeping barberry
Western wheatgrass	Pale agoseris	Rabbitbrush
Common Timothy	Prairie onion	Quaking aspen
Mountain brome	Yellow salsify	Rocky Mountain juniper
Spike trisetum	Yellow sweetclover	Shrubby cinquefoil
Plains muhly	Arnica sororia	Silver sagebrush
	American licorice	Douglas fir
	Cinquefoil	Saskatoon serviceberry
	Common yarrow	Threetip sagebrush
	Prickly lettuce	
	Richardson geranium	
	Sticky geranium	
	American licorice	
	Fireweed	
	Lupine	
	Sedges	

SOURCES: Kirsch 1962; Mackie 1965; Rouse 1957.

Fisheries

Fisheries are primarily confined to the Yellowstone and Missouri rivers, and their major tributaries (see map 25). The semiarid climate is not conducive to maintaining fish habitat and populations in most intermittent streams. Fish populations and fish habitat in perennial and intermittent streams are impacted by drought and hot temperatures, prolonged cold, heavy icing, and by flooding.

Most ponds and streams, including the major ephemeral and intermittent drainages, were inventoried for fish distribution (Elser and Denson 1977, Elser et al. 1980). Abundant and widespread nongame fish are: white sucker, longnose dace, fathead minnow, plains minnow, western silvery minnow, brassy minnow, and flathead chub (see table 35). The Yellowstone, Missouri, Musselshell, and Redwater rivers provide sport fisheries as do the tributary streams of Fox Creek, Big Dry Creek, Little Dry Creek, and Beaver Creek. The Missouri River is typically a warmwater fishery that offers sturgeon, northern pike, channel catfish, burbot, white crappie, pumpkinseed, and sauger. The Yellowstone River yields catches of sturgeon, walleye, channel catfish, burbot, green sunfish, bluegill, crappie, sauger, and paddlefish (Elser et al. 1980).

TABLE 35
NONGAME FISH IN THE PLANNING AREA

Common Name	
Pallid sturgeon	Fathead minnow
Carp	Longnose dace
Golden shiner	River carpsucker
Pearl dace	Blue sucker
Creek chub	Smallmouth buffalo
Northern redbelly dace	Bigmouth buffalo
Flathead chub	Shorthead redhorse
Sturgeon chub	Longnose sucker
Lake chub	White sucker
Emerald shiner	Mountain sucker
Sand shiner	Stonecat
Brassy minnow	Brook stickleback
Plains minnow	Iowa darter
Western silvery minnow	Freshwater drum

SOURCE: Elser et al. 1980.

Fish Species of Special Interest and Concern in the Yellowstone and Missouri rivers are the paddlefish, pallid sturgeon, shortnose gar, and the sturgeon chub. Paddlefish is a species of concern because only seven populations are thought to be in existence in the world at the present time. The Yellowstone and Missouri rivers contain one of the last stable populations of paddlefish.

The planning area has 9 livestock reservoirs that support fisheries on the public lands (see table 36). Major species include rainbow trout, largemouth bass, crappie, and yellow perch. The Montana Department of Fish, Wildlife and Parks monitors the fish populations and stocks the ponds regularly. Rainbow trout do not reproduce in stock ponds so are restocked, except in low-water years. Largemouth bass, crappie, and yellow perch will reproduce in most stock ponds. Pond fisheries have cycles of dry, low-water years when summer heat causes major fish kills; winters with extended periods of ice and snow have the same effect. The stock ponds need a minimum depth of 10 to 15 feet to support the fish populations; however, a greater depth is preferred to minimize winterkill and to avoid oxygen depletion. New fishery reservoirs should be at least 20 feet deep to compensate for siltation.

TABLE 36
FISHERY RESERVOIRS

Name	Location	Species
Beardsley	T. 9 N., R.52 E., sec.14	RBT
Boulware	T. 6 N., R.54 E., sec.5	RBT
Clark	T. 13 N., R.48 E., sec.18	RBT
Harms	T. 13 N., R.48 E., sec.31	RBT
Homestead	T. 14 N., R.49 E., sec. 7	LMB, SMB
Maier	T. 8 N., R.58 E., sec.24	LMB, CR, YP
Oil Pump	T. 13 N., R.56 E., sec.30	RBT
Silvertip	T. 13 N., R.48 E., sec.24	LMB, SMB
South Fork	T. 13 N., R.48 E., sec.17	RBT

LEGEND: CR = Crappie
LMB = Largemouth Bass
RBT = Rainbow Trout
SMB = Smallmouth Bass
YP = Yellow Perch

Nongame

Nongame animals are those not commonly pursued, hunted, or used for food, sport, or profit. Often, they are enjoyed by wildlife viewers or photographers. The Montana Department of Fish, Wildlife and Parks has identified Species of Special Interest or Concern (Flath 1993) whose numbers or habitat may be limited in the foreseeable future, if not properly managed. For those species potentially found within the planning area, see table 37. Numerous nongame birds occupy various habitats; some are specific to a particular kind, but the highest densities occur in the riparian/wetlands. Most nongame birds are migratory.

Black-tailed prairie dogs occupy approximately 2,500 acres of public land within the resource area and are normally found on flat to gently rolling grasslands. Prairie dog towns provide habitat for more than thirty animal species, including the burrowing owl (species of special interest), swift fox (category 2 species), mountain plover (category 1 species), and black-footed ferret (endangered). Prairie dogs compete for forage with wildlife and livestock. In the past, prairie dog towns covered thousands of acres, but disease, improved grazing, and control programs have reduced the number significantly.

Current management allows for the natural fluctuations of prairie dog populations. In the past 15 years two small control efforts have been conducted in cooperation with private landowners. One of the control efforts was successful, while the second was unsuccessful.

TABLE 37
SPECIES OF SPECIAL INTEREST OR CONCERN

Mammals	Birds	Reptiles	Amphibians	Fish
Northern long-eared bat	Whooping crane	Snapping turtle	Canadian toad	Sticklefin chub
Spotted bat	Dickcissel	Spiny softshell turtle		Sturgeon chub
Black-footed ferret	Bald eagle	Milk snake		Pearl dace
Swift fox	Peregrine falcon	Smooth green snake		Shortnose gar
Lynx	Northern goshawk	Western hognose snake		Paddlefish
Meadow jumping mouse	Ferruginous hawk			Northern redbelly x Finscale dace
Fringed myotis	White-faced ibis			Pallid sturgeon
Black-tailed prairie dog	Common loon			Blue sucker
Merriam's shrew	Burrowing owl			
Preble's shrew	Mountain plover			
	Piping plover			
	Loggerhead shrike			
	Bairds sparrow			
	LeContis sparrow			
	Sage sparrow			
	Black tern			
	Least tern			

SOURCE: Flath 1993.

The "Wildlife" section in the Big Dry Resource Area's Management Situation Analysis contains a list of the vertebrate species that inhabit the planning area (USDI, BLM 1990a). This includes 7 species of amphibians, 14 species of reptiles, 61 species of mammals, and 306 species of birds.

Threatened and Endangered Species

The bald eagle and the least tern are federally-listed endangered birds, and the piping plover is a federally-listed threatened bird.

Bald eagle recovery zones include the Powder and Missouri rivers. The Missouri River has no known nesting bald eagles. Bald eagles nest along the Yellowstone River in Rosebud and Custer counties. The Yellowstone River is used during spring and fall migrations. Peak occurrence is November through April. The Missouri, Yellowstone, Musselshell, and Powder rivers provide habitat during migration as well as during the winter months. Bald eagles concentrate in and around areas of open water where waterfowl and fish are available. Bald eagles currently are expanding their nesting territories down the Yellowstone River (Flath 1990).

The least tern is known to nest in the planning area. Its habitat includes graveled islands associated with major rivers; one island adjacent to public land contains a colony of nesting least terns. During spring and fall migrations, the least tern uses stockwater reservoirs.

The piping plover exist in the northern part of the planning area. Most sightings are north of the Missouri River. Its high value habitat is associated with natural saline wetlands. Recent surveys show that there is one parcel of public land used by piping plover for nesting and brood rearing. Although the minerals are federally owned in the piping plover habitat, there is no federal coal suitable for development.

As opposed to the piping plover, the mountain plover is associated with the short-grass prairie. In this area, the prairie dog colonies provide the best habitat for the mountain plover. The mountain plover is a category 1 species and may be listed as threatened or endangered.

The endangered whooping crane and the peregrine falcon migrate through the planning area, but do not nest or winter here. Although the habitat is conducive to the endangered black-footed ferret. This species is not believed to be present in the area at this time.

The federally-endangered pallid sturgeon exists in the Yellowstone and Missouri rivers within the planning area. It relies on free-flowing river habitat with rocky or sandy bottoms.

The Montana Black-footed Ferret Working Group has studied prairie dog towns capable of supporting black-footed ferrets. They are assessing the possibility of black-footed ferret reintroduction, and released a paper (Clark et al. 1986) suggesting eight possible reintroduction sites in Montana. One of these sites is located in Custer and Prairie counties. If a proposal is made by the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife and Parks to reintroduce the black-footed ferret, further planning would be needed.

Game Birds

Sharp-tailed grouse are abundant in the planning area (see map 28), and are found in grasslands, grassland-shrubs, woodlands, riparian/wetlands, and agricultural habitats. The residual vegetation associated with these habitats are important for food and cover. Residual vegetation of 4 to 6 inches in height provides important nesting cover as well as security for broods. Nests normally are found within two miles of leks (dancing grounds). The planning area contains 310 known leks; 45 are on the public lands (see table 38).

Sharp-tailed grouse prefer grasses, forbs, and cultivated grains in the spring; insects, leaves, dry seed, and fruits in the summer; grasses, seed, cultivated grains, and fruits of various trees and shrubs in the fall. Important food plants include alfalfa, clover, chokecherry, dandelion, and buffaloberry. During winter, the woody draws contain buffaloberry, snowberry, juniper, and wild rose for food and cover. If snow is not available for burrowing during severe winters, shrubs must be available for thermal cover. Studies show that sharp-tailed grouse can move some distance to find these shrubs (Nielson 1978).

TABLE 38
KNOWN SHARP-TAILED GROUSE LEKS
IN THE PLANNING AREA

County	Private Land	BLM-Administered Land	Other Federal and State Land	Mixed[1]	Total
Custer	3	1	0	0	4
Daniels	17	0	2	1	20
Dawson	73	0	10	3	86
Fallon	5	4	1	2	12
Garfield	11	3	0	0	14
McCone	7	3	0	0	10
Prairie	22	25	3	1	51
Richland	16	0	0	2	18
Roosevelt	20	0	1	0	21
Rosebud	7	0	0	0	7
Sheridan	26	0	20	0	46
Wibaux	20	0	1	0	21
Total	227	36	38	9	310

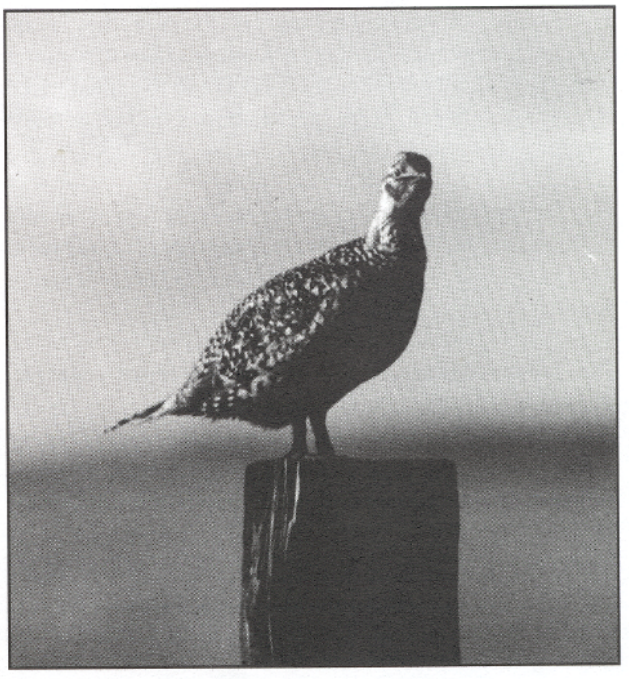
SOURCE: BLM, Big Dry Resource Area files.

[1]Includes public and private ownership

There was a sighting that could possibly be a northern swift fox. This may indicate the species is present within the planning area. Northern swift fox habitat is present on public land within the planning area.

Sage grouse occupy approximately 247,500 acres on the public lands (see map 28), 16,000 acres of which are considered crucial winter range (see map 24). Sage grouse are primarily associated with big and silver sagebrush communities in grassland-shrub and shrub vegetation types. The importance of sagebrush to sage grouse is well documented. Sage grouse wintering and nesting habitats are managed to sustain a sagebrush component of 15 to 30 percent canopy coverage. Nesting habitat is located under sagebrush, and within 2 miles of leks (strutting grounds) (Wallestad and Pyrah 1974; Martin 1970).

Sagebrush provides 80 to 100 percent of their winter diet (Wallestad and Schladweiler 1975, Martin 1970, Eng and Schladweiler 1972). For winter, the sage grouse prefer an area where shrubs are at least 12 inches high, and within 2 miles of their leks. Forbs, especially dandelion and salsify, are an important dietary component for the juveniles and adults in the spring and summer. The planning area has 148 known leks in the planning area, with 46 on the public lands.



Sharp-tailed grouse.

TABLE 39
KNOWN SAGE GROUSE LEKS
IN THE PLANNING AREA

County	Private Land	BLM-Administered Land	Other Federal and State Land	Mixed[1]	Total
Custer	6	3	1	0	10
Fallon	1	1	0	1	3
Garfield	40	12	2	4	58
McCone	0	1	0	0	1
Prairie	7	14	1	3	25
Rosebud	42	4	2	3	51
Total	96	35	6	11	148

SOURCE: BLM, Big Dry Resource Area files.
[1]Includes public and private ownership

The largest game bird in Montana is Merriam's wild turkey. Although native to North America, it was first introduced to Montana in 1954 (Walchek 1990). Wild turkeys occupy the timbered streams, rivers, and the ponderosa pine hills and areas in proximity to agricultural lands and ranches where they can easily obtain food, especially in winter. Large roosting trees such as cottonwoods and ponderosa pine are important year-round. In the spring and summer, green grasses and forbs provide food for the adult birds. Small grains, weed seed, and pine seeds are consumed during the fall and winter months. Poults (young turkeys) primarily eat insects during their first spring and summer.

Merriam's wild turkey.

Waterfowl are the most prominent and economically important migratory birds in North America. The planning area contains Canada geese, as well as 19 species of ducks, including the mallard, pintail, blue-winged teal, green-winged teal, American widgeon, gadwall, and northern shoveler. The planning area's northern portion contains part of the Prairie Potholes region (covering five states) which is widely acknowledged as the most important waterfowl producing area in North America (USDI, BLM 1989b). In wet years, the Prairie Potholes region has the potential to produce more than half the annual duck population in North America. The Northern Great Plains region directly south of the Prairie Potholes region is not as productive, but vital, nevertheless.

Water is the paramount factor in duck production; ducks nest within 2 miles of permanent water sites. Native grassland communities adjacent to wetlands are important nesting habitats for mallards and pintails. Although natural potholes are crucial for waterfowl nesting, reservoirs have become increasingly important in dry years and are often the only water source during drought periods. There are approximately 960 reservoirs, averaging 3-surface acres in size, located on the public lands in the planning area.

In the spring, waterfowl depend primarily on upland areas near reservoirs and islands for nesting. Duck production varies from one to nine per surface acre of water, depending on their nesting cover. Early nesters such as mallards and pintails begin nesting in late April and depend on residual cover from the previous year. Blue-winged teal, American widgeon, and gadwall begin nesting about four weeks later, and are dependent upon the current vegetative cover. Broods use emergent aquatic and shoreline vegetation for food and cover during the late spring and summer. Both the Yellowstone and Missouri rivers are important waterfowl areas. Canada goose production on the Yellowstone River and its tributaries is significant.

Islands constructed on 35 public land reservoirs are important to Canada geese and some duck species because they provide security from predators during nesting and brood rearing. Canada geese appear to be expanding their range from large historical breeding waters to reservoirs throughout the planning area. The largest variety and number of waterfowl occur during fall and spring migrations when the birds utilize standing grain crops and wetlands. Migratory waterfowl use the major rivers for roosting, cover, and feeding.